SDMS US EPA REGION V

COLOR - RESOLUTION - 3

IMAGERY INSERT FORM

Multiple pages of this document include color or resolution variations and may be illegible in SDMS due to bad source documents. Unless otherwise noted, these pages are available in monochrome. (The source document page(s) are more legible than the images.) The original document is available for viewing at the Superfund Records Center.

SITE NAME	SAUGET AREA 1
DOC ID #	160646
DOCUMENT VARIATION	X COLOR **OR** ___ RESOLUTION
PRP	SAUGET AREA 1
PHASE	REM
OPERABLE UNITS	
PHASE (AR DOCUMENTS ONLY)	___ Remedial ___ Removal ___ Deletion Docket ___ ___ Original ___ Update # ___ Volume ___ of ___

COMMENT(S)

COLOR MAPS & GRAPHS

EE/CA and RI/FS Support Sampling Plan

Sauget Area 1

Sauget and Cahokia, Illinois

Volume 1A

Support Sampling Plan

June 25, 1999

Submitted To:

U.S. Environmental Protection Agency
Chicago, Illinois

Submitted By:

Solutia Inc.
St. Louis, Missouri

1.0 EE/CA and RI/FS Support Sampling Plan

The objective of this EE/CA and RI/FS Support Sampling Plan (SSP) is to further determine the extent of contamination at the Site beyond that defined by previous site investigations. This plan contains a description of equipment specifications, required analyses, sample types, and sample locations and frequency. The plan addresses specific hydrologic, hydrogeologic and air transport methods including, but not limited to, geologic mapping, geophysics, field screening, drilling and well installation, flow determination, and soil, water, sediment, sludge, and waste sampling to determine the extent of contamination. Data requirements are identified for specific remedial technologies that may be necessary to evaluate removal and remediation activities in the EE/CA and the RI/FS.

Solutia is committed to performing the work required by the January 21, 1999 Administrative Order on Consent and Scope of Work (AOC/SOW) in a responsive, responsible and cost-effective manner that is consistent with the National Contingency Plan (NCP). Solutia is the only PRP signatory to the AOC; more than twenty other PRPs declined to participate in the investigation of Dead Creek and evaluation of short-term removal actions for acute threats to the community and the environment and long-term remedies for chronic threats to the community and the environment.

The Sauget Area 1 Support Sampling Plan Engineering Evaluation/Cost Analysis for Soil, Surface Water, Sediment and Air and Remedial Investigation/Feasibility Study for Groundwater sets forth the steps Solutia plans to undertake in performing the work required by the AOC SOW. This is a complicated project because of the age of the sites, the varied nature of the contaminants and the number of sites requiring investigation.

Six source areas exist in the head waters of Dead Creek: Site G, Site H, Site I, Site L, Site M and Site N. The AOC SOW requires collection of waste, groundwater and air samples at all six of these fill areas. Wastes in these sources, which have an estimated total area of greater than 30 acres, came from a wide variety of municipal and industrial sources. Current Agency estimates indicate that these sites have a total volume in excess of 400,000 cubic yards. Site

G is a fill area stabilized by USEPA in an emergency response that solidified organic wastes, placed a temporary soil cover over the site and controlled site access by installation of a fence. Recent inspection indicates the site is still stable. Site H is a grass field at the intersection of two major roads, Queeny Avenue and Falling Springs Road. It is across the street from the Cahokia Village Hall. Recent inspection indicates the site is stable with a vegetative cover and no wastes exposed at the surface. Cinders are present at the surface in some areas of the site. Commercial buildings and a self-storage facility are located on the site. Site I is stable since it underlies a large, fenced, controlled-access, gravel-covered truck parking lot, the Sauget Village Hall and paved parking lots.

Site L, which is covered with cinders, is located in a vegetated field and appears stable. Site M is a water-filled borrow pit hydraulically connected to Dead Creek. Its banks are well vegetated and there is no evidence of current erosion and/or transport of sediments to Dead Creek. For these reasons the site is considered stable. Site N is located at the rear of a former construction company site that is now occupied by what appears to be a sign company. The stability of Site N could not be assessed because it was not visible from publicly accessible areas. Evidence of site clearing across the entire parcel was readily discernible from Fallling Springs Road. This site reportedly contains construction rubble.

Dead Creek was divided by IEPA into six segments during past investigations: Creek Segments A, B, C, D, E and F. One segment, Creek Segment A, was remediated in 1990 and 1991 by Cerro Copper under an IEPA-approved plan and needs no further characterization. The AOC SOW requires collection of soil, sediment, surface water, sediment and ecological samples in Creek Segments B, C, D, E and F.

All five media (soil, groundwater, surface water, sediment and air) are being investigated at the six source areas and soil, groundwater, sediment and surface water are being investigated in the Dead Creek watershed. Analytical parameters include VOCs, SVOCs, Metals, Mercury, Cyanide, PCBs, Pesticides, Herbicides and Dioxin. The human health risk assessment will evaluate exposure of indoor industrial workers, construction/utility workers, residents, recreational teenagers and recreational fishers to soil, groundwater, surface water, sediments and air. The ecological risk assessment will evaluate benthic community structure and the impact of surface water, sediments, benthic organisms, vegetation, crawfish and fish on six assessment endpoint organisms: 1) large mouth bass, 2) mallard duck, 3) great blue heron, 4) bald eagle, 5) muskrat and 6) river otter.

This Support Sampling Plan presents a comprehensive investigation of the extent of migration of site-related constituents away from six source areas via the soil, groundwater, surface water, sediment and air pathways in a large study area more than three miles long. It includes a comprehensive evaluation of human health and ecological risks associated with migration of site-related constituents. Solutia intends to perform the work in accordance with the AOC and the NCP.

The Support Sampling Plan is submitted in accordance with the requirements of the AOC and SOW; the March 19, 1999 USEPA comments on the February 22, 1999 Draft Support Sampling Plan; the March 25, 1999 telephone conference call between Solutia and USEPA, USACE, Weston and IEPA regarding the Agency's March 19, 1999 comments; the March 26, 1999 telephone conference call between Solutia and USEPA, USACE and IEPA on the Agency's March 19, 1999 comments and the May 29, 1999 USEPA, USACE and Weston comments on the April 9, 1999 Support Sampling Plan.

Solutia responded positively to all comments made by USEPA, USACE, Weston and IEPA in March 1999 and incorporated these responses into the Support Sampling Plan with two exceptions: 1) a description of ownership and 2) collection of groundwater samples west of Route 3. Ownership records for a three mile long study area with hundreds of property owners are too voluminous to include in this document. Solutia proposes that these documents be maintained separately from the Support Sampling Plan. Furthermore, the Agency and the IEPA have a recent study by Ecology and Environment that sets forth ownership of the properties.

Extensive groundwater characterization data will be collected east of Route 3 as part of the SSP. Before collecting groundwater samples west of Route 3, where there are a number of other sources (this area is part of Sauget Area 2 and contains sites that are likely source areas themselves, e.g. the former Midwest Rubber facility, the old Darling Fertilizer facility and the Clayton Chemical facility), Solutia is proposing to evaluate the data from the currently planned SSP groundwater data collection effort to determine if site-related constituents have migrated as far as Route 3 before a decision is made as to whether or not groundwater sampling west of Route 3 is necessary as a Sauget Area 1 study activity. If such sampling is necessary, Solutia is prepared to propose an appropriate supplement to this SSP to conduct such sampling.

Solutia reviewed all of the May 29, 1999 USEPA, USACE and Weston comments and most of them were included in the June 25, 1999 Support Sampling Plan.

The Support Sampling Plan consists of the following documents:

Volume 1A Support Sampling Plan
Volume 1B Human Health Risk Assessment Work Plan
Volume 1C Ecological Risk Assessment Work Plan
Volume 1D EE/CA Report Work Plan
Volume 1E RI/FS Report Work Plan

Volume 2A Soil, Groundwater, Surface Water and Air Field Sampling Plan
Volume 2B Soil, Groundwater, Surface Water and Air Quality Assurance Project Plan
Volume 2C Soil, Groundwater, Surface Water and Air Health and Safety Plan

Volume 3A Ecological Sampling QAPP/FSP
Volume 3B Ecological Sampling Health and Safety Plan

Volume 4 Data Validation Plan

Specific requirements of the January 21, 1999 AOC SOW are addressed in the corresponding sections of the Support Sampling Plan as outlined below:

AOC SOW Work Element		Support Sampling Plan Volume
Task 1	EE/CA and RI/FS Support Sampling Plan	Volume 1A, Section 1.0
	Site Background	Volume 1A, Section 2.0

	Description	Volume 1A, Section 3.0
	Waste Characterization	Volume 1A, Section 3.1
	Hydrogeologic Investigation	Volume 1A, Section 3.2
	Soils and Sediment Investigation	Volume 1A, Sections 3.3 and 3.4
	Surface Water Investigation	Volume 1A, Section 3.5
	Air Investigation	Volume 1A, Section 3.6
	Ecological Investigation	Volume 1A, Section 3.8
	Pilot Tests	Volume 1A, Section 3.9
	Sampling Procedures	Volumes 2A, 2B and 3A
	Health and Safety Plan	Volumes 2C and 3B
	Schedule	Volume 1A, Section 16.0
Task 2	EE/CA and RI/FS Support Sampling	
	Waste Characterization	Volume 1A, Section 5.0
	Hydrogeologic Investigation	Volume 1A, Section 6.0
	Soils and Sediment Investigation	Volume 1A, Sections 7.0 and 8.0
	Surface Water Investigation	Volume 1A, Section 9.0
	Air Investigation	Volume 1A, Section 10.0
	Ecological Investigation	Volume 1A, Section 11.0
	Pilot Tests	Volume 1A, Section 12.0
Task 3	Data Report	Volume 1A, Section 13.0
Task 4	EE/CA Report for Soil, Sediment, Sediment and Air (including a streamlined human health risk assessment and an ecological risk assessment	Volumes 1B, 1C and 1D
Task 5	RI/FS Report (Groundwater)	Volumes 1B, 1C and 1E
	RI Report	
	Risk Assessment for Groundwater	
	Establish Remedial Action Goals	
	Feasibility Study	

2.0 Site Background

Sauget Area 1 is located in the Villages of Sauget and Cahokia, St. Clair County, Illinois. The study area is centered on Dead Creek, an intermittent stream that is approximately 17,000 feet long, and its floodplain. Three closed municipal/industrial landfills (Sites G, H and I), one backfilled wastewater impoundment (Site L), one flooded borrow pit (Site M) and one backfilled borrow pit (Site N) are present in the study area which also includes six creek segments:

Creek Segment A	Alton & Southern Railroad to Queeny Avenue
Creek Segment B	Queeny Avenue to Judith Lane
Creek Segment C	Judith Lane to Cahokia Street
Creek Segment D	Cahokia Street to Jerome Lane
Creek Segment E	Jerome Lane to Route 157
Creek Segment F	Route 157 to Old Prairie du Pont Creek

These sites and creek segments are shown on Figure 1.

2.1 Land Use

During recent years land use has been consistent in the area surrounding Dead Creek. In a 1988 report prepared for IEPA (Expanded Site Investigation, Dead Creek Project Sites at Cahokia/Sauget, Illinois), Ecology and Environment indicated that "A wide variety of land utilization is present [in the study area]. The primary land use in the town [village] of Sauget is industrial, with over 50% of the land used for this purpose. Small residential, commercial, and agricultural properties are also interspersed throughout the town [village]. Significant land use features, in relation to individual project sites will be discussed below.

Land surrounding the Area 1 project sites is used for several purposes. A small residential area is located immediately east of Sites H and I, across Falling Springs Road. The nearest residence is approximately 200 feet from these sites. The Sauget Village Hall is also located on top of, or adjacent to, Site I .... South of Sites G and L are two small cultivated fields which are used for soybean production. These fields separate the sites from a residential area in the northern portion of Cahokia. Several small commercial properties are also found in the immediate vicinity of the Area 1 sites." These land use patterns are typical of Dead Creek east of its intersection with Route 3 (Mississippi Avenue). Immediately south of Route 3 there is a residential area. After this developed area, Dead Creek runs through undeveloped area until it reaches the lift station at Old Prairie du Pont Creek.

2.2 Climate

Geraghty and Miller, in a report prepared for Monsanto (Site Investigation for Dead Creek Segment B and Sites L and M, Sauget-Cahokia, Illinois, 1992), indicates that "The climate of the site(s) is continental with hot, humid summers and mild winters. Periods of extreme cold are short. The average annual rainfall in the area for the period from 1903 to 1983 was 35.4 inches, however, precipitation increased to 39.5 inches per year during the period between 1963 and 1988. The average annual temperature is 56°F; the highest average monthly temperature (79 °F) occurs in July and the lowest average monthly temperature (32 °F) occurs in January."

2.3 Hydrology

According to Ecology and Environment (1988) "the project area lies in the floodplain, or valley bottom, of the Mississippi River in an area known as the American Bottoms. For the most part the topography consists, of nearly flat bottom land, although many irregularities exist locally across the site areas.... Generally, the land surface in undisturbed areas slopes from north to south, and from the east toward the river. This trend is not followed in the immediate vicinity of [Sauget Area 1]. Elevations of Area 1 sites range from 410 to 400 feet above mean sea level (MSL) ... Little topographic relief is exhibited across individual sites, with the exception of Sites G ...

Surface drainage in the project area is typically toward ... Dead Creek. However, significant site-specific drainage patterns are present. A brief description of surface drainage for individual sites is given below.

Site G - Drainage at Site G is generally east toward CS-B. A large depression exists in the south-central portion of the site. Surface runoff flows toward the depression [Note: As a result of an emergency response action by USEPA in 1995, Site G is capped and surface water flow is directed radially away from the site].

Site H - Drainage at Site H is typically to the west toward CS-B. Several small depressions capable of retaining rainwater, are scattered across the site. Precipitation in these areas infiltrates the ground surface rather than draining from the site.

Site I - Drainage is generally to the west toward the two holding ponds which make up CS-A [Note: Creek Segment A was closed under an IEPA approved plan in 1990/91. Impacted sediments were removed and transported off-site for disposal, an HDPE membrane vapor barrier was installed, a storm water retention basin was constructed and the site was backfilled to create a controlled-access truck parking lot. Water that used to be impounded in CS-A now drains to the new storm water retention basin]. CS-A also receives surface and roof drainage from the entire Cerro plant area located west of CS-A. This drainage flows through a series of storm sewers and effluent pipes. A large depression exists in the northern portion of Site I [Note: This depression no longer exists]. Precipitation in this area flows toward the depression.

Site L - Site L is a former subsurface impoundment which has subsequently been covered with highly permeable material (cinders). Runoff from the surface, although inhibited by the permeable nature of the cinders, flows toward CS-B.

Site M - Site M receives surface runoff from a small residential area located east and south of the site. Water in Site M eventually drains into CS-B through a cut-through located in the southwest corner of the site.

Site N - Because the excavation which constitutes Site N [is] only partially filled, it receives runoff from the surrounding area. The creek bank in this area is approximately ten feet higher than the lowest point in the excavation.

Dead Creek - Dead Creek serves as a surface water conduit for much of the Sauget and Cahokia area. The creek runs south and southwest through these towns [villages] to an outlet point in the [O]ld Prairie Du Pont [sic] Creek floodway, located south of Cahokia. The floodway in turn discharges to the Cahokia Chute of the Mississippi River. ... Creek Segment A is isolated from the remainder of Dead Creek because the culvert under Queeny Avenue has been blocked with concrete. CS-A drains to an interceptor at the north end of the Cerro property. Water from this interceptor is carried to the Sauget Waste Water Treatment Plant. The culvert is partially blocked at the south end of CS-B, and flow from this Segment to the remainder of the creek is restricted. Although the degree of this restriction has not been determined, it is known that water does not usually flow through this culvert."

2.4 Geology

Geraghty and Miller (1992) described site geology as follows "The site(s) is situated on the floodplain of the Mississippi River. The floodplain is locally named the American Bottoms and contains unconsolidated valley fill deposits composed of recent alluvium (Cahokia Alluvium), which overlies glacial material (Henry Formation). Published information indicates that these unconsolidated deposits are underlain by bedrock of Pennsylvanian and Mississippian age consisting of limestone and dolomite with lesser amounts of sandstone and shale.

The Cahokia Alluvium (recent deposits) consists of unconsolidated, poorly sorted, fine-grained materials with some local sand and clay lenses. These recent alluvium deposits unconformably overlie the Henry Formation which is Wisconsinian glacial outwash in the form of valley train deposits. The Henry Formation is about 100 feet thick. These valley-train materials are generally medium to course sand and gravel and increase in grain size with depth."

2.5 Water Resources

2.5.1 Domestic Water Supply

Ecology and Environment (1988) conducted an evaluation of groundwater and surface water resources and the results of this evaluation are summarized below.

"The primary source of drinking water for area residents is an intake in the Mississippi River. This intake is located at river mile 181, approximately 3 miles north of the DCP [Dead Creek Project] study area. The drinking water intake is owned and operated by the Illinois American Water Company (IAWC) of East St. Louis, and it serves the majority of residences in the DCP area. IAWC supplies water to ... Sauget .... The Commonfields of Cahokia Public Water District purchases water from IAWC and distributes it to portions of Cahokia and Centerville Township. The Cahokia Water Department also purchases water from IAWC and distributes it to small residential areas in the west and southwest portions of Cahokia.

A review of IDPH and ISGS files indicated that at least 50 area residences [within a 3 mile radius of the site] have wells which are used for drinking water or irrigation purposes. These wells are located in Cahokia (23) ....The nearest private wells to any of the DCP sites are located on Judith Lane, immediately south of the Area 1 sites. Based on interviews with these well owners, only one of the five wells located in this area is used occasionally as a source of drinking water and the other four are never used for this purpose.

In summary, although the majority of residences in the general project area are serviced by public water supply systems, well over 50 homes [within a 3 mile radius of the site] utilize private well supplies for drinking water or irrigation purposes."

2.5.2 Industrial Water Supply

Ecology and Environment (1988) also described industrial water usage. "Industrial groundwater usage has been very extensive in the past. Peak use occurred in 1962 when groundwater pumpage exceeded 35 million gallons per day (mgd). Relatively few industries utilize well-supplied groundwater for process or cooling water. Total groundwater pumpage from industrial sources in the project area [3 mile radius] is estimated to be less than 0.5 mgd." [Note: Groundwater usage is probably even lower today given the decline in the region's industrial base.]

2.5.3 Downstream Surface Water Intakes

Ecology and Evironment (1988) indicated that "the nearest downstream surface [water] intake on the Illinois side of the Mississippi River is located at river mile 110, approximately 64 miles south of the project area. This intake supplies drinking water to residents in the Town of Chester and surrounding areas in Randolf County, Illinois. The nearest potentially impacted public water supply on the Missouri side of the river is located at river mile 149, approximately 28 miles south of the DCP area. The Village of Crystal City, Missouri (pop. 4,000) located 28 miles south of the DCP area, utilizes a Ranney well adjacent to the Mississippi River as a source for drinking water. Although this is not actually a surface water intake, it is assumed that the well draws water from the river due to its construction and location adjacent to the river."

2.5.4 Agricultural Water Supply

Ecology and Evironment (1988) reported that "Although agricultural land is found throughout the immediate project area, this land is apparently not irrigated. The nearest irrigated land, other than residential lawns and gardens, is located in the Schmids Lake-East Carondelet area [south of Old Prairie du Pont Creek which is the end of Sauget Area 1]."

2.6 Existing Fill Area Information

USEPA, IEPA, Monsanto/Solutia and Cerro Copper have collected a considerable amount of information on soil, groundwater, surface water and sediment in Sauget Area 1. Information included in the January 21, 1999 AOC is given verbatim below. The location of Sites G, H, I, L, M and N and Creek Segments B, C, D, E and F are shown on Figure 1.

2.6.1 SITE G

"Located south of Queeny Avenue, east of (and possibly under) the Wiese Engineering facility, and north of a cultivated field in the Village of Sauget. CS-B of Dead Creek is located along the eastern boundary of the Site. This site is approximately 5 acres in size and it was operated and served as a disposal area from approximately 1952 to the late 1980's. The Site was fenced in 1988 pursuant to a U.S. EPA removal action under CERCLA which was funded by potentially responsible parties, including Monsanto. On information and belief, wastes located on the surface and/or in the subsurface of Site G have spontaneously combusted and/or burned for long periods of time on several occasions. U.S. EPA conducted a second CERCLA removal action at Site G in 1995. This removal action involved the excavation of PCB, organics, metals, and dioxin contaminated soils on and surrounding Site G, solidification of open oil pits on the Site, and covering part of the Site (including the excavated contaminated soils) with a clean soil cap approximately 18 to 24-inches thick. Site G is enclosed by a fence and is not currently being used. The property is vegetated.

Site G operated as a landfill from approximately 1952 to 1966. The site was subject to intermittent dumping thereafter until 1988, when the Site was fenced. There is an estimated 60,000 cubic yards of wastes within Site G, including oil pits, drums containing wastes, paper wastes, documents and lab equipment. Soil samples collected from Site G revealed elevated levels of VOCs such as chloroform (11,628 ppb), benzene (45,349 ppb), tetrachloroethene (58,571 ppb), chlorobenzene (538,462 ppb), and total xylenes (41,538 ppb). Soil samples also revealed elevated levels of SVOCs such as phenol (177,800 ppb), naphthalene (5,428,571 ppb), 2,4,6-trichlorophenol (49,530 ppb), and pentachlorophenol (4,769,231 ppb). Elevated levels of the pesticide 4,4-DDE were detected up to 135,385 ppb. Elevated levels of PCBs were detected at levels as high as 174,419 ppb (Aroclor 1248) and 5,300,000 ppb (Aroclor

1260). Dioxin levels in soils at Site G were detected at levels as high as 44,974 ppb. Metals were detected at elevated concentrations such as arsenic (123 ppm), barium (45,949 ppm), copper (2,215 ppm), lead (3,123 ppm), mercury (34.3 ppm), nickel (399 ppm), and zinc (4,257 ppm). Samples collected from wastes which appeared to be a pure solid product material on Site G revealed PCB levels as high as 3,000,000 ppb and dioxin levels in excess of 50,661 ppb.

Groundwater samples collected from beneath Site G revealed elevated levels of VOCs such as trans-1,2-dichloroethene (200 ppb), 1,2-dichloroethane (480 ppb), trichloroethene (800 ppb), benzene (4,100 ppb), tetrachloroethene (420 ppb), toluene (7,300 ppb), and ethyl benzene (840 ppb). Elevated levels of SVOCs were detected such as 1,2,4-trichlorobenzene (1,900 ppb), naphthalene (21,000 ppb), 4-chloroaniline (15,000 ppb), and 2,4,6-trichlorophenol (350 ppb). An elevated concentration of PCBs was detected at 890 ppb (Aroclor 1260). Elevated metals in groundwater beneath Site G included arsenic (179 ppb), mercury (2.1 ppb), nickel (349 ppb), zinc (1,910 ppb) and cyanide (350 ppb)."

2.6.2 SITE H

"Located south of Queeny Avenue, west of Falling Springs Road and west of the Metro Construction Company property in the Village of Sauget, it occupies approximately 5 to 7 acres of land. The southern boundary of Site H is not known with certainty but it is estimated that the fill area extends approximately 1,250 feet south of Queeny Avenue. Site H is connected to Site I under Queeny Avenue and together they were known to be part of the Sauget-Monsanto Landfill [Note: Sauget used to be known as Monsanto until the name of the village was changed] which operated from approximately 1931 to 1957. Site H is not currently being used and the property is graded and grass-covered with some areas of exposed slag.

Due to the physical connection to Site I, waste disposal at Site H was similar to that at Site I. Chemical wastes were disposed of here from approximately 1931 to 1957. Wastes included drums of solvents, other organics and inorganics, including PCBs, para-nitro-aniline, chlorine, phosphorous pentasulfide, and hydrofluosilic acid. Municipal wastes were also reportedly disposed of at Site H. The estimated volume of wastes in Site H is 110,000 cubic yards. There is no containment beneath Site H. Soil samples collected at Site H revealed elevated levels of VOCs such as benzene (61,290 ppb), tetrachloroethene (5,645 ppb), toluene (76,450 ppb), chlorobenzene (451,613 ppb), ethyl benzene (12,788 ppb), and total xylenes (23,630 ppb). Elevated levels of SVOCs were also found in soil samples such as 1,4-dichlorobenzene (30,645,161 ppb), 1,2 dichlorobenzene (19,354,839 ppb), 1,2,4-trichlorobenzene (7,580,645 ppb), 4-nitroaniline (1,834,000 ppb), phenanthrene (2,114,000 ppb), and fluoranthene (1,330,000 ppb). Soil samples also revealed elevated levels of PCBs such as Aroclor 1260 (18,000,000 ppb), and pesticides 4,4DDE (780 ppb), 4,4-DDD (431 ppb), and 4,4-DDT (923 ppb). Elevated levels of metals were found such as arsenic (388 ppm), cadmium (294 ppm), copper (2,444 ppm), lead (4,500 ppm), manganese (36,543 ppm), mercury (3.9 ppm), nickel (15,097 ppm), silver (44 ppm), and zinc (39,516 ppm).

Groundwater samples collected from beneath Site H revealed elevated levels of VOCs such as chloroform (3,000 ppb), benzene (4,300 ppb), and toluene (7,300 ppb). Elevated levels of SVOCs were detected in groundwater such as phenol (950 ppb) and pentachlorophenol (650 ppb). An elevated level of PCBs (Aroclor 1260 at 52 ppb) was also detected in groundwater at Site H. Elevated levels of metals were also detected in groundwater such as arsenic (8,490 ppb), copper (2,410 ppb), nickel (17,200 ppb) and cyanide (480 ppb)."

2.6.3 SITE I

"Located north of Queeny Avenue, west of Falling Springs Road and south of the Alton & Southern Railroad in the Village of Sauget it occupies approximately 19 acres of land. Segment CS-A of Dead Creek borders Site I on the Site's western side. The site is currently graded and covered with crushed stone and used for equipment and truck parking. Site I was originally used as a sand and gravel pit which received industrial and municipal wastes. Site I is connected to Site H (see below) under Queeny Avenue and together they were known to be part of the "Sauget-Monsanto Landfill." The landfill operated from approximately 1931 to 1957. On information and belief, wastes from Site I leached and/or were released into CS-A and available downstream creek segments until CS-A was remediated in 1990. [Note: The culvert between Creek Segment A and Creek Segment B was blocked in the 1970s.] On information and belief, Site I served as a disposal area for contaminated sediments from historic dredgings of Dead Creek Segment A.

On information and belief, this site accepted chemical wastes from approximately 1931 to the late 1950's. Municipal wastes were also disposed of in Site I. Site I contains approximately 250,000 cubic yards of contaminated wastes and fill material. No subsurface containment is in place beneath Site I. Soil samples collected from Site I have revealed elevated levels of volatile organic compounds (VOCs) such as 1,1,1-trichloroethane (1,692 ppb), trichloroethene (3,810 ppb), benzene (24,130 ppb), tetrachloroethene (5,265 ppb), toluene (77,910 ppb), chlorobenzene (126,900 ppb), ethyl benzene (15,070 ppb), and total xylenes (19,180 ppb). Soil samples also revealed elevated levels of semi-volatile organic compounds (SVOCs) such as 1,3-dichlorobenzene (70,140 ppb), 1,4 dichlorobenzene (1,837,000 ppb), 1,2-dichlorobenzene (324,000 ppb), naphthalene (514,500 ppb), and hexachlorobenzene (1,270,000 ppb). Soil samples also revealed elevated levels of polychlorinated biphenyls (PCBs), such as Aroclor 1260 (342,900 ppb), and the pesticides 4,4-DDD (29,694 ppb), 4,4-DDT (4,305 ppb) and toxaphene (492,800 ppb). Elevated levels of metals were also found in soils, such as beryllium (1,530 ppm), copper (630 ppm), lead (23,333 ppm), zinc (6,329 ppm) and cyanide (3,183 ppm).

Groundwater samples collected from beneath Site I have revealed elevated levels of VOCs such as vinyl chloride (790 ppb), trichloroethene (279 ppb), benzene (1,400 ppb), tetrachloroethene (470 ppb), toluene (740 ppb), and chlorobenzene (3,100 ppb). Elevated levels of SVOCs were also detected in groundwater, such as phenol (1,800 ppb), bis-(2-chloroethoxy)methane (2,900 ppb), 1, 2, 4-trichlorobenzene (2,700 ppb), 4-chloroaniline (9,600 ppb), and pentachlorophenol (2,400 ppb)."

2.6.4 SITE L

"Located immediately east of Dead Creek CS-B and south of the Metro Construction Company property in the Village of Sauget. Site L is the former location of two surface impoundments used from approximately 1971 to 1981 for the disposal of wash water from truck cleaning operations. This site is now covered by black cinders and is used for equipment storage. On information and belief, Site L wastes have migrated into Site M (see below).

This site was originally used as a disposal impoundment from approximately 1971 to 1981. The volume of contaminated fill material in Site L is not known, however, the area of the impoundment is estimated to be 7,600 square feet. There is no known containment of wastes beneath Site L. Soil samples collected at Site L revealed elevated levels of VOCs such as chloroform (20,253 ppb), benzene (4,177 ppb), and toluene (26,582 ppb). Elevated levels of SVOCs were also detected such as 2-chlorophenol (2,152 ppb), pentachlorophenol (58,228 ppb), and di-n-butyl phthalate (2,784 ppb). Total PCBs were found at a level of 500 ppm in soils. Elevated levels of metals were detected such as antimony (32 ppm), arsenic (172 ppm), and nickel (2,392 ppm).

Groundwater samples collected from beneath Site L revealed elevated levels of VOCs such as chloroform (730 ppb) and benzene (150 ppb). SVOCs were also detected in groundwater such as phenol (150 ppb), 2-chlorophenol (130 ppb)., 4-methyl phenol (75 ppb), 2-nitrophenol (41 ppb), and 4-chloroaniline (60 ppb). Elevated levels of metals in groundwater included arsenic (14,000 ppb), cadmium (32 ppb) and zinc (2,210 ppb)."

2.6.5 SITE M

"Located along the eastern side of Dead Creek CS-B (south of Site L) at the western end of Walnut Street in the Village of Cahokia. Site M was originally used as a sand borrow pit (dimensions = 220 feet by 320 feet) in the mid to late 1940's. The pit is hydrologically connected to Dead Creek through an eight-foot opening at the southwest portion of the pit. On information and belief, wastes from CS-B have in the past and potentially continue to migrate into Site M via this connection. The site is currently fenced.

Site M was originally constructed as a sand borrow pit in the mid to late 1940's. This pit is approximately 59,200 square feet in size and previous investigations indicate that approximately 3,600 cubic yards of contaminated sediments are contained within the pit. It is estimated that the pit is approximately 14 feet deep and it is probable that there is a hydraulic connection between this pit water and the underlying groundwater. Surface water samples collected from Site M revealed elevated levels of VOCs such as chloroform (27 ppb), toluene (19 ppb) and chlorobenzene (33 ppb). SVOCs detected in surface water included phenol (28 ppb), 2-chlorophenol (14 ppb), 2,4-dimethyl phenol (13 ppb), 2,4-dichlorophenol (150 ppb), and pentachlorophenol (120 ppb). Pesticides detected in surface water include dieldrin (0.18 ppb), endosulfan II (.06 ppb), 4,4-DDT (0.24 ppb), 2,4-D (47 ppb) and 2,4,5-TP (Silvex) (3.4 ppb). PCBs were also detected in surface water at a maximum level of 0.0044 ppb

Sediment samples collected from Site M revealed elevated levels of VOCs such as 2-butanone (14,000 ppb), chlorobenzene (10 ppb) and ethyl benzene (0.82 ppb). SVOCs detected in sediments included 1,4-dichlorobenzene (40 ppm), 1,2-dichlorobenzene (26 ppm), 1,2,4-trichlorobenzene (14 ppm), pyrene (27 ppm), fluoranthene (21 ppm), chrysene (12 ppm), and benzo(b)fluoranthene (15 ppm). Total PCB levels were detected as high as 1,100 ppm. Elevated levels of metals were also detected in sediments at Site M, including antimony (41.2 ppm), barium (9,060 ppm), cadmium (47.2 ppm), copper (21,000 ppm), nickel (2,490 ppm), silver (26 ppm), zinc (31,600 ppm), lead (1,910 ppm), arsenic (94 ppm) and cyanide (1.3 ppm)."

2.6.6 SITE N

"Located along the eastern side of Dead Creek CS-C, south of Judith Lane and north of Cahokia Street in the Village of Cahokia. This Site encompasses approximately 4 to 5 acres of previously excavated land used to dispose of concrete rubble and demolition debris. The excavation began in the 1940's and the site is currently inactive and fenced.

Initially developed as a borrow pit in the 1940's, this Site has been filled with concrete rubble, scrap wood and other demolition debris. The depth of the fill may be as much as 30 feet and it occupies approximately 4 to 5 acres of land. Soil samples collected from Site N revealed the presence of SVOCs such as phenanthrene (434 ppb), fluoranthene (684 ppb), and pyrene (553 ppb). An elevated level of mercury (9 ppm) was also detected in soil at Site N."

2.7 Existing Dead Creek Information

According to the AOC,

"Dead Creek stretches from the Alton & Southern Railroad at its northern end and flows south through Sauget and Cahokia for approximately 3.5 miles before emptying into the Old Prairie du Pont Creek, which flows approximately 2,000 feet west into a branch of the Mississippi River known as the Cahokia Chute. For many years, Dead Creek has been a repository for local area wastes. On December 21, 1928, an easement agreement between local property owners and representatives of local business, municipal and property interests was executed to "improve the drainage in that District (Dead Creek) by improving Dead Creek so as to make it suitable for the disposal of wastewater, industrial waste, seepage and storm water." Thereafter, Dead Creek systematically received direct and indirect discharges from local businesses and from the Village for many years to come.

Creek Segment CS-A is the northernmost segment of the creek. It is approximately 1,800 feet long and 100 feet wide, running from the Alton & Southern Railroad to Queeny Avenue. This segment of the creek originally consisted of two holding ponds which were periodically dredged. For several years, CS-A and available downstream segments (e.g., ones that were not blocked off) received direct wastewater discharges from industrial sources and served as a surcharge basin for the Village of Sauget (formerly the Village of Monsanto) municipal sewer collection system. When the system became backed up or overflowed, untreated wastes from industrial users of the sewer system were discharged directly into CS-A. On several occaisions, CS-A was dredged and contaminated sediments were disposed of onto adjacent Site I. IN 1968, the Queeny Avenue culvert, which allowed creek water to pass from CS-A to CS-B, was permanently blocked by the Village of Sauget.

Remediation work was conducted by Cerro Copper in CS-A in 1990. Approximately 27,500 tons of contaminated sediments were removed to RCRA and TSCA permitted facilities. CS-A is now filled and covered with crushed gravel. Land use surrounding CS-A is industrial.

Creek Segment CS-B extends for approximately 1,800 feet from Queeny Avenue to Judith Lane. Sites G, L and M border this creek segment. Land use surrounding CS-B is primarily commercial with a small residential area near the southern end of this segment. Agricultural land lies to the west of the creek and south of Site G. In 1965, the Judith Lane culvert, which allowed creek water to pass from CS-B to CS-C, was blocked. CS-B is hydrologically connected to Site M by a manmade ditch (see above).

Creek Segment CS-C extends for approximately 1,300 feet from Judith Lane south to Cahokia Street. Site N borders this creek segment. Land use is primarily residential along both sides of CS-C.

Creek Segment CS-D extends for approximately 1,100 feet from Cahokia Street to Jerome Land. Land use is primarily residential along both sides of CS-D.

Creek Segment CS-E extends approximately 4,300 feet from Jerome Lane to the intersection of Illinois Route 3 and Route 157. Land use surrounding CS-E is predominantly commercial with some mixed residential use. Dead Creek temporarily passes through corrugated pipe at the southern end of CS-E.

Creek Segment CS-F is approximately 6,500 feet long and extends from Route 157 to the Old Prairie du Pont Creek. CS-F is the widest segment of Dead Creek and a large wetland area extends several hundred feet out from both sides of the creek.

Information on the types of wastes disposed of and the types and levels of contamination found at the Sauget Area 1 Site have been provided to U.S. EPA from various sources, including, but not exclusively from: 1) CERCLA 103(c) Submittals; 2) CERCLA 104(e) Responses; 3) Expanded Site Investigation Dead Creek Project Sites (E & E, 1988); 4)

Removal Action Plan for Dead Creek Sites (Weston-SPER, 1987); 5) Description of Current Situation at the Dead Creek Project Sites (E & E, 1986); 6) Site Investigations for Dead Creek Segment B and Sites L and M (Geraghty & Miller, Inc. 1992); 7) Site Investigation/Feasibility Study for Creek Segment A (Advent Group, 1990); 8) Preliminary Ecological Risk Assessment for Sauget Area 1, Creek Segment F (E & E,1997); 9) EPA Removal Action Report for Site G (E & E 1994); 10) Area One Screening Site Inspection Report; and 11) Site Investigation Feasibility Study for Creek Segment A (Advent Group 1990)."

2.7.1 Creek Segment A

"Approximately 20,000 cubic yards of contaminated material were removed from this segment of Dead Creek in 1990, and the area was then backfilled with clean material. The assumption that only low-levels of residual contamination may currently exist within CS-A is yet to be confirmed. Prior to remediation activities, soil and sediment samples collected from CS-A revealed elevated levels of VOCs such as 1,2-dichloroethene (15,000 ppb), trichloroethene (100,000 ppb), tetrachloroethene (11,000 ppb), chlorobenzene (31,000 ppb), ethyl benzene (80,000 ppb), and xylene (500,000 ppb). Elevated levels of SVOCs detected in soils and sediments included 1,3-dichlorobenzene, 4-chloroaniline (17,000 ppb), acetophenone (24,000 ppb), 1, 2, 4, 5-tetrachlorobenzene (28,000 ppb), pentachlorobenzene (37,000 ppb), phenathrene (14,000 ppb), and pyrene (10,000 ppb). Elevated levels of PCBs (total) were also detected at a maximum concentration of 3,145,000 ppb. Elevated levels of metals were also detected in soils and sediments in CS-A including silver (348 ppm), arsenic (194 ppm), cadmium (532 ppm), copper (91,800 ppm), mercury (124 ppm), nickel (6,940 ppm), lead (32,400 ppm), antimony (356 ppm), selenium (41.6 ppm), and zinc (26,800 ppm)."

2.7.2 Creek Segment B

"Elevated levels of VOCs and SVOCs were detected in sediment samples collected from CS-B such as benzene (87 ppb), toluene (810 ppb), chlorobenzene-(5,200 ppb), ethyl benzene (3,600 ppb), trichlorobenzene (3,700 ppm), dichlorobenzene (12,000 ppm), chloronitrobenzene (240 ppm), xylenes (540 ppm), 1,4-dichlorobenzene (220,000 ppb), 1,2-dichlorobenzene (17,000 ppb), phenanthrene (15,000 ppb), fluoranthene (11,000 ppb), pyrene (13,000 ppb). Elevated levels of PCBs exist within CS-B at levels as high as 10,000 ppm. Elevated levels of metals were also detected in sediments in CS-B including arsenic (6,000 ppm), cadmium (400 ppm), copper (44,800 ppm), lead (24,000 ppm), mercury (30 ppm), nickel (3,500 ppm), silver (100 ppm), and zinc (71,000 ppm).

Surface water samples collected from CS-B revealed elevated concentrations of VOCs such as chloroform (27 ppb), 1,1-dichloroethene (3 ppb), toluene (20 ppb), and chlorobenzene (33 ppb). SVOCs detected in surface water included phenol (28 ppb), 2-chlorophenol (14 ppb), 1,4-dichlorobenzene, 2-methyl phenol (4 ppb), 4-methyl phenol (35 ppb), 2,4-dichlorophenol (150 ppb), naphthalene (8 ppb), 3-nitroaniline (9 ppb), and pentachlorophenol (120 ppb). Pesticides were also detected in surface water samples including dieldrin (0.18 ppb), 4,4-DDT (0.24 ppb), 2,4-D (47 ppb) and Silvex (3.4 ppb). An elevated level of PCBs (aroclor 1260) was also detected in the surface water of CS-B at a level of 44 ppb. Elevated levels of metals were detected in surface water such as aluminum (9,080 ppb), barium (7,130 ppb), arsenic (31 ppb), cadmium (25 ppb), chromium (99 ppb), copper (17,900 ppb), lead (1,300 ppb), mercury (8.6 ppb), nickel (1,500 ppb), and zinc (10,300 ppb)."

2.7.3 Creek Segment C

"Elevated levels of VOCs and SVOCs were detected in sediments in this segment of Dead Creek including fluoranthene (4,600 ppb), pyrene (4,500 ppb), benzo(a)anthracene (3,300 ppb), chrysene (4,400 ppb), benzo(b)fluoranthene (7,500 ppb), benzo(a)pyrene (4,500 ppb), indeno(1,2,3-cd)pyrene (4,300 ppb), benzo(g, h, I) perylene (1,500 ppb), dibenzo(a, h)anthracene (4,000 ppb), and 4-methyl-2-pentanone (1,200 ppb). PCBs (total) were also detected in sediments from CS-C at a maximum concentration of 27,500 ppb. Sediment samples also revealed elevated levels of metals such as copper (17,200 ppm), lead (1,300 ppm), nickel (2,300 ppm), zinc (21,000 ppm) and mercury (2.81 ppm).

Surface water samples collected from creek segment CS-C revealed elevated levels of metals such as lead (710 ppb), mercury (1.9 ppb), and nickel (83 ppb)."

2.7.4 Creek Segment D

"Elevated concentrations of VOCs and SVOCs were detected in sediment samples collected from CS-D including 4-methyl-2-pentanone (1,200 ppb), benzo(b)fluoranthene (500 ppb), indeno(1, 2, 3-cd)pyrene (310 ppb), and dibenzo(a, h)anthracene (360 ppb). PCBs (total) were detected in sediments at a maximum concentration of 12,000 ppb. Elevated concentrations of metals were also detected such as cadmium (42 ppm), copper (1,630 ppm), lead (480 ppm), mercury (1 ppm), and zinc (6,590 ppm).

Surface water samples collected from CS-D revealed elevated concentrations of metals such as cadmium (8.1 ppb), lead (89 ppb), and nickel (189 ppb)."

2.7.5 Creek Segment E

"Elevated concentrations of VOCs and SVOCs were detected in sediment samples collected from CS-E including chlorobenzene (120 ppb), pyrene (5,300 ppb), benzo(b)fluoranthene (2,400 ppb), and chrysene (2,800 ppb). Elevated levels of PCBs (total) were also detected at a maximum concentration of 59,926 ppb. Elevated levels of metals were also detected in the sediments of CS-E including cadmium (23.1 ppm), copper (8,540 ppm), lead (1,270 ppm), mercury (1.53 ppm), nickel (2,130 ppm), and zinc (9,970 ppm)."

2.7.6 Creek Segment F

"Elevated concentrations of VOCs and SVOCs were detected in the sediments of CS-F such as toluene (29 ppb), 4-methyl phenol (1,100 ppb), fluoranthene (310 ppb), and pyrene (340 ppb). Pesticides were also detected in the sediments such as 4,4-DDE (97 ppb), endrin (66 ppb), endosulfan 11 (203 ppb), and methoxychlor (8 ppb). PCBs (total) were also detected in sediments at a maximum concentration of 5,348 ppb. Elevated levels of metals were also detected in the sediments such as arsenic (276 ppm), lead (199 ppm), mercury (0.55 ppm), cadmium (23.5 ppm), copper (520 ppm), nickel (772 ppm) and zinc (4,520 ppm). Elevated concentrations of dioxins were also detected in sediments in CS-F at a maximum concentration of 211 picograms per gram."

2.8 Existing Data

In 1998, Ecology and Environment prepared a report (Sauget Area 1 Data Tables/Maps) for USEPA Region 5 that "summarized existing technical and potentially responsible party (PRP) data for each subunit of the sites along with other information compiled during E & E's file searches of various agencies and organizations." This report contains the following information obtained from work done by Illinois EPA (IEPA), Ecology and Environment (E&E), Weston, Geraghty & Miller (G&M) and The Advent Group.

Volume 1 - Sauget Area 1

Introduction
Report Organization
Site G
- Site Narrative
- Analytical Data Summaries
  - Sediment Samples - Organics and Metals (IEPA, 1984)
  - Surface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1986)
  - Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)
  - Soil Samples - PCB and PCP (Weston, 1987)
  - Waste/Soil Samples - Metals and Organics (IEPA, 1984)
  - Soil Samples - VOCs (G&M, 1991)
  - Soil Samples - BNAs, Metals, Pesticides/PCBs (E&E, 1986)
  - Soil Samples - VOCs, BNAs, Pesticides/PCBs (IEPA, 1994)

Site H
- Site Narrative
- Analytical Data Summaries
  - Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)

Site L
- Site Narrative
- Analytical Data Summaries
  - Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)
  - Soil Samples - PCBs (IEPA, 1981)

Sediment Samples - VOCs, BNAs, PCBs, Metals 9G&M, 1991)
Subsurface Soil Samples - TCLP Metals, VOCs, BNAs, Pesticides/PCBs (G&M, 1991)
Site I
Site Narrative
Analytical Data Summaries
Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)
Creek Segment A
Site Narrative
Analytical Data Summaries
Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)
Sediment Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Surface Water Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1986)
Soil Samples - PCBs, Metals (IEPA, 1981)
Sediment Samples - Metals and Organics (IEPA, 1981)
Surface Water Samples - Metals and Organics (IEPA, 1981)
Soil/Sediment Samples - VOCs, BNAs, PCBs, PCB Precursors, Metals (Advent Group, 1990)
Site M
Site Narrative
Analytical Data Summaries
Surface Water Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Sediment Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1986)
Sediment/Surface Water Samples - VOCs, BNAs, Metals, PCBs, RCRA Hazardous Characteristic Parameters (G&M, 1992)
Water/Sediment Samples - Metals and Organics (IEPA, 1980)
Surface Water Samples - VOCs, BNAs, Pesticides/PCBs, Metals, Herbicides (IEPA, 1994)
Soil/Sediment Samples - Metals (IEPA, 1980)
Creek Segment B
Site Narrative
Analytical Data Summaries
Sediment Soil Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Surface Water Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Sediment Samples - BNAs, VOCs, Metals (G&M, 1991)
Soil/Sediment Samples - Metals, Pesticides/PCBs, VOCs, BNAs (G&M, 1991)
Sediment Samples - RCRA Hazardous Characteristic Parameters (G&M, 1991)
Soil Sediment Samples - Organics, Phosphorus, Metals (IEPA/Monsanto, 1980)
Surface Water Sample - Metals (Eastep, 1975)
Surface Water Samples - VOCs, BNAs, Metals, Pesticides/PCBs (IEPA, 1993/94)
Soil/Sediment Samples - Metals, Organics (IEPA, Sept. 1980)
Soil/Sediment Samples - Metals, Organics (IEPA, Oct. 1980)
Site N
Site Narrative
Analytical Data Summaries
Subsurface Soil Samples - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1986)
Creek Segment C

Site Narrative
Analytical Data Summaries
Sediment Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Surface Water Samples - VOCs, BNAs, Pesticides/PCBs, Metals, (E&E, 1986)
Sediment/Soil Samples - Metals and Organics (IEPA, 1980)
Water Samples - Metals and Organics (IEPA, 1980)
Soil Samples - Metals and Organics (IEPA, 1991)
Sediment Samples - Metals (IEPA, 1980)
Surface Water Samples - VOCs, BNAs, Metals, Pesticides/PCBs (IEPA, 1993)
Water Samples - Metals (IEPA, 1980)
Creek Segment D
Site Narrative
Analytical Data Summaries
Sediment Samples - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1986)
Surface Water Samples - VOCs, BNAs, Pesticides/PCBs, Metals, (E&E, 1986)
Sediment Samples - VOCs, SVOCS, Pesticides/PCBs, Inorganics, Metals (IEPA, 1991)
Creek Segment E
Site Narrative
Analytical Data Summaries
Sediment Samples - VOCs, SVOCS, Pesticides/PCBs, Inorganics, Metals (IEPA, 1991)
Sediment Samples - Metals and Organics (IEPA, 1980)
Water Samples - Metals and Organics (IEPA, 1980)
Sediment Samples - Metals (IEPA, 1980)
Water Samples - Metals (IEPA, 1980)
Creek Segment F
Site Narrative
Analytical Data Summaries
Sediment Samples - Metals, PCBs (E&E, 1997)
Soil/Sediment Samples - VOCs, SVOCs, Pesticides/PCBs (IEPA, 1991)
Sediment Samples - VOCs, SVOCs, Pesticides/PCBs, Inorganics, Metals (IEPA, 1991)
Soil/Sediment Samples - Metals and Organics (IEPA, 1990)
Area 1 Groundwater
Site Narrative
Creek Segment B - Metals/Indicators (IEPA, 1980)
Site G - VOCs, BNAs, Metals (E&E, 1987)
Site H - VOCs, BNAs, Pesticides/PCBs, Metals (E&E, 1987)
Site I - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1987)
Site L - VOCs, BNAs, Metals, Pesticides/PCBs (E&E, 1987)
Private Wells - VOCs, BNAs, Pesticide/PCBs, Metals (E&E, 1987)
Groundwater Monitoring Survey - Organics and Metals (IEPA, 1982)
Monitoring Well Samples - Metals, Pesticides/PCBs (IEPA, 1980 and 1983)
Groundwater Samples - VOCs, SVOCs, Pesticides/PCBs, Inorganics (IEPA, 1991)
Water Samples - PCBs (IEPA and Monsanto, 1980)
Groundwater Samples - Metals and Organics (IEPA, 1981)

Groundwater Samples - Metals and Organics (IEPA, 1981)
Groundwater Samples - VOCs, SVOCs, Pesticides/PCBs, Metals (IEPA, 1991)

The 1998 Ecology and Environment Sauget Area 1 Data Tables/Maps Report is not included in the SSP at the request of the Agency. A summary of this information will be included in the Support Sampling Plan Data Report.

2.9 Existing Risk Assessments

In 1997 Ecology and Environment prepared the report "Preliminary Ecological Risk Assessment for Sauget Area1, Creek Segment F, Sauget, St. Clair County, Illinois". E&E "was tasked by the United States Environmental Protection Agency (U.S. EPA) to prepare a screening-level ecological risk assessment for the Sauget Area 1, Creek Segment F site ... The objective of this report is to determine whether the site poses no immediate or long-term ecological risk, or if a potential ecological risk exists and further evaluation is necessary."

Conclusions and recommendations of the report are given below:

"Based on this investigation, site contamination does not appear to threaten human health. Sediment contamination levels are below risk-based values and few people enter the site boundaries.

Elevated levels of metals and PCBs may be highly detrimental to the ecology of this site [Creek Segment F]. The presence of arsenic, cadmium, and dioxin greater than SEL guidelines may decrease the species richness of the area. Sensitive species, including the endangered Black-Crowned Night Heron, inhabit the site and therefore, are subject to effects such as acute toxicity, reduced growth, inhibited reproduction, and other adverse effects. Finally, species that feed on contaminated organisms may bioaccumulate the contaminants and become adversely affected.

The contamination on the site [Creek Segment F] warrants further investigation and possible remediation, especially because it provides high quality wetland habitat."

This report is included in the SSP as Appendix A.

3.0 Site Characterization

The January 21, 1999 Administrative Order on Consent Scope of Work identified the site characterization information needed to define the extent of contamination at Sauget Area 1 for purposes of implementing a removal action on the source areas and Dead Creek and for implementing a remedial action for groundwater. In addition, an analysis of currently available data was done to determine the areas of the Site that required characterization data in order to define the extent of contamination for purposes of implementing a removal action on the source areas and Dead Creek and for implementing a remedial action for groundwater.

Sections 5.0 to 12.0 of this SSP address activities designed to provide site characterization data. These sections describe the number, types and locations of additional samples that will be collected as part of this SSP.

3.1 Waste

The AOC SOW requires inclusion of a program in the SSP for characterizing the waste materials at the Site including an analysis of current information/data on past disposal practices, test pits/trenches and deep soil borings to determine waste depths and volume and extent of cover over fill areas, soil gas surveys on and around fill areas and geophysical delineation of potential "hot spot" drum removal areas. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, the identified waste characterization data includes:

- Past disposal practices
- Waste depths and volumes
- Extent of cover over fill areas
- Soil gas survey on and around fill areas
- Buried drum and tank identification

Section 5.0, Waste Characterization Sampling Plan, describes the work that will be performed under this SSP to obtain this waste characterization data.

3.2 Groundwater

The AOC SOW requires inclusion of a program in the SSP for performing a hydrogeologic investigation at the Site including assessment of the degree of hazard, regional and local flow direction and quality and local uses of groundwater. In addition, the SSP was required to develop a strategy for determining horizontal and vertical distribution of contaminants and to include slug tests, grain size analyses and upgradient samples. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, the identified groundwater characterization data includes:

- Degree of hazard and mobility of constituents
- Discharge and recharge areas
- Regional and local flow direction and quality
- Local uses of groundwater
- Horizontal and vertical distribution of constituents
- Slug tests
- Grain size analyses
- Upgradient samples

Section 6.0, Ground Water Sampling Plan, describes the work that will be performed under this SSP to obtain this groundwater characterization data.

3.3 Soil

The AOC SOW requires inclusion of a program in the SSP for performing a soil investigation at the Site to determine the extent of contamination of surface and subsurface soils, sampling of leachate from the fill areas and sampling of soil in commercial/open areas adjacent to Dead Creek. The AOC SOW indicates that residential soil sampling may also be required depending on the results from the commercial/open area sampling. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, soil characterization data includes:

- Extent of contamination of surface and subsurface soils
- Leachate samples from fill areas
- Soil sampling of residential/commercial areas adjacent to Dead Creek

Section 7.0, Soil Sampling Plan, describes the work that will be performed under this SSP to obtain this soil characterization data.

3.4 Sediment

The AOC SOW requires inclusion of a program in the SSP for performing a sediment investigation at the Site to determine the extent and depth of contaminated sediments in all segments of Dead Creek and its tributaries and surrounding wetland areas. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, sediment characterization data includes:

- Extent and depth of contamination in sediments

Section 8.0, Sediment Sampling Plan, describes the work that will be performed under this SSP to obtain this soil characterization data.

3.5 Surface Water

The AOC SOW requires inclusion of a program in the SSP to determine the areas of surface water contamination in Dead Creek and its tributaries and surrounding wetland areas. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, surface water characterization data includes:

- Areas of surface water contamination in Dead Creek and its tributaries and surrounding wetland areas

Section 9.0, Surface Water Sampling Plan, describes the work that will be performed under this SSP to obtain surface water characterization data.

3.6 Air

The AOC SOW requires inclusion of a program in the SSP to determine the extent of atmospheric contamination from the various source areas at the Site and to address the tendency of substances identified through waste characterization to enter the atmosphere, local wind patterns and their degree of hazard. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, air characterization data includes:

- Tendency of constituents to enter the atmosphere
- Tendency of constituents to enter local wind patterns
- Degree of hazard

Section 10.0, Air Sampling Plan, describes the work that will be performed under this SSP to obtain air characterization data.

3.7 Ecological Assessment

The AOC SOW requires inclusion of a program in the SSP to collect data for the purpose of assessing the impact, if any, to aquatic and terrestrial ecosystems within and adjacent to Sauget Area 1 resulting from the disposal, release and migration of contaminants. This program must include a description of ecosystems affected, an evaluation of toxicity, an assessment of endpoint organisms and exposure pathways. It also must include a description of toxicity testing or trapping to be done as part of the assessment. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, ecological assessment includes:

- Affected ecosystem description
- Evaluation of toxicity
- Assessment of endpoint organisms
- Exposure pathways
- Toxicity testing or trapping

Section 11.0, Ecological Assessment Sampling Plan, describes the work that will be performed under this SSP to ecological assessment data.

3.8 Pilot Treatability Tests

The AOC SOW requires inclusion of a program in the SSP for any pilot tests necessary to determine the implementability and effectiveness of technologies where sufficient information is not otherwise available. Based on the AOC SOW requirements, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, pilot treatability tests include:

- Waste Incineration
- Waste Thermal Desorption
- Sediment Thermal Desorption
- Sediment Stabilization
- Leachate Treatment

Section 12.0, Pilot Treatability Test Sampling Plan, describes the work that will be performed under this SSP to perform these pilot treatability tests.

4.0 Topographic Map and Sample Location Surveying

4.1 Topographic Map

Surdex, an aerial photography and mapping subcontractor, flew the study area in late March to obtain current aerial photographs of the study area prior to the spring emergence of vegetation. These photographs, combined with ground control surveying, will be used to prepare a topographic map of the study area with a 1 inch = 50 foot scale and a topographic contour interval of 1 ft. This map will consist of 19 30-inch by 40-inch sheets and it will meet National Map Standards with a horizontal accuracy of +/- 1.25 ft. and a vertical accuracy for contour lines of +/- 0.5 ft.

4.2 Location and Elevation Surveying

All sampling locations will be determined in the field using a GPS system capable of producing decimal latitude and longitude readings accurate to one meter. Well elevations will be surveyed to an accuracy of +/- 0.01 ft.

5.0 Waste Characterization Sampling Plan

Fill area samples will be collected in order to characterize the wastes present at each site and to provide information for the human health risk assessment (construction/utility worker exposure). The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP.

5.1 Past Disposal Practices and Analytical Parameter Selection

5.1.1 Overview of Disposal Information Available

Solutia has reviewed disposal practice histories included in prior reports and updated those reports with information submitted to U.S. EPA in 104(e) request responses and 103(c) submittals in order to identify analytical parameters to be used in this SSP. In addition Solutia has reviewed material it has collected pursuant to FOIA requests to the State of Illinois and the U.S. EPA regarding disposal in Sauget Area 1. Also, Solutia has reviewed information it collected in its own private investigations of the Sauget Area 1 sites. Based on this review, it is clear that because of the age of the sites and the characteristics of some of the sites, information regarding disposals in some sites is limited or non-existent. Despite this clear gap in information, Solutia has set forth the information it has that describes possible disposals or releases that occurred at the sites.

5.1.2 Disposals into the Village Sewer and Dead Creek

Up until sometime in the 1930's Dead Creek flowed through the property now occupied by the Solutia's William G. Krummrich ("WGK") plant. In the 1930's the Village of Sauget sewer system was installed. Prior to this installation, industrial process waste water from many of the East St. Louis and Sauget industries flowed directly into Dead Creek. Sometime in the 1930s Monsanto filled in the portion of Dead Creek located on its property. Storm water, not process waters, continued to flow off the property into Dead Creek through a 36-inch culvert under the railroad tracks at the south side of the property.

In 1932 the first public system of sewers was designed for the Village. The new sewers were constructed in 1932 to 1933. This included a 24-inch sewer north of Dead Creek running east to west. It also included an 18-inch sewer line that flowed from Route 3 eastward into Dead Creek. The 18-inch line served Midwest Rubber and possibly Darling Fertilizer. It handled both stormwater and process water. It may have also carried sanitary and commercial waste to Dead Creek.

Sometime between 1939 and 1943 the Village took over maintenance and control of the 36-inch culvert pipe. It also installed Manhole 24 in the 24-inch sewer line at the north end of Dead Creek and ran the 36-inch culvert pipe into the manhole. By connecting the 36-inch pipe to the sewer system, the pipe could act as a conduit for water in the section of Dead Creek south of WGK to flow north into the sewer, and at times of overload on the sewer, the pipe would act as a conduit of sewer backflow into Dead Creek. At about this same time Dead Creek was blocked at Queeny Ave to function as a surge pond for the Village of Sauget sewer system. It can be assumed that this project, which in effect incorporated Dead Creek into the Village sewer system, was paid for, at least in part, by federal funding received by the Village for expansion of the sewer system because of war time industrial development.

In 1935, the creek was dredged between Monsanto's plant and Queeny Avenue. Dredged material was deposited along the east bank. Such dredging may have occurred more than once.

In 1951 additional sewers along Mississippi Avenue were constructed. At this time, the 18-inch overflow line from Mississippi Avenue was connected to the Village sewer system so that normally only storm water would be discharged to Dead Creek and the industrial wastewater was discharged northward and stayed in the Village sewer system. The 18-inch line was still able to act as an overflow for the rest of the system.

Cerro effluent discharged through eight pipes directly into Dead Creek Segment A (CS-A) until 1966 when an interceptor line along Dead Creek was constructed the purpose of which was to discharge Cerro's waste water into the Village sewer system. An interceptor box was constructed during the Cerro sewer work. It was designed to allow the overflow of wastewater from Manhole 24 to Dead Creek to continue. Even after the interceptor line was installed, it is possible that unidentified sewer discharges from Cerro still entered the creek through the direct discharge pipes and through the Cerro connection to the Village sewer.

The amount of sewer discharges from area industries gradually decreased over the years. In 1966 various industries started to implement process changes that reduced the quantity of wastewater discharged to the sewer. After a 42-inch sewer was constructed by Monsanto in the 1980's, overflows into Dead Creek were likely to occur only during significant rainfall events. After 1984, increased sewer capacity further reduced the frequency of overflows to Dead Creek.

In addition to the 18-inch overflow line that ran from Mississippi Ave. east to Dead Creek Segment B, there were two sewer overflow lines that entered CS-A on the east side. These two overflow lines are in addition to the junction box at the north end of the Creek One outfall was on the north end of CS-A The other line ran west from the 8-inch north-south line along Queeny Avenue to Dead Creek. This line was basically residential but could also have been a source of industrial discharges.

Based on this above description of the history of the use of Dead Creek as part of the Sauget Village sewer system, it is evident that any industry discharging waste waters into the sewer is a suspect source of contamination in Dead Creek and Site I because of the disposal of dredged material from the creek onto Site I.

As of 1929, the following industries were reported as operating in Sauget:

- Cahokia Power Plant
- Darling & Co. Fertilizer
- Evans-Wallower Zinc
- Floyd Plant Co.
- Lewin Metals (now known as Cerro Copper)
- Lubrite Refining (later operated by Mobil)
- Midwest Rubber

- Monsanto Chemical Works
- Sterling Steel Casting Co.

As of 1942, all the above companies were in operation except for Floyd Plant Co and Evans-Wallower Zinc, which presumably had a name change to American Zinc. Added to the list of sewer users by 1942 were Federal Chemical Co. and the U.S. Chemical Warfare Service. Any and/or all of these industries could have been directly discharging into Dead Creek.

The following descriptions give additional information on the industries that are known to have discharged into the Village sewer system:

Amax Zinc

Zinc production started at the Amax Zinc facility in 1929. An electrolytic refinery operates at the Site which has over the years produced the following products:

- Refined zinc metal
- Zinc alloys
- Zinc powders
- Zinc sulfate monohydrate
- Zinc oxide
- Electrolytic or commercial grade sulfuric acid
- Cadmium products
- Raw material used at the plant include zinc sulfide concentrates.

The waste water discharged from the plant contained zinc, copper, iron, cadmium, magnesium and PCBs.

Chemical Warfare Service

The Chemical Warfare Service plant, owned and operated by the U.S. Government, was constructed in the summer of 1940 by Monsanto pursuant to instructions received from the Chemical Warfare Service. After construction, Monsanto operated the plant under the direct supervision and direction of the Chemical Warfare Service. Spills and leaks at the plant were washed into the plant sewer which was connected to the village sewer. It is likely that process waste water was also discharged into the sewer. Because of government confidentiality restrictions it has been difficult to identify possible contaminants from this source.

Cerro Copper

Cerro has operated a copper smelting operation in Sauget since before 1929. Its predecessor company was Lewin Metals. Generally its operations involve the refining and smelting of copper. In the 1950's, for about 10 years, Cerro manufactured brass rod and tubing. The raw material came from scrap materials (i.e. scrap copper and brass).

Cerro's waste water was known to contain the following contaminants:

- Arsenic
- Cadmium
- Copper
- Nickel
- Zinc
- Antimony
- Beryllium
- Lead
- Silver
- Oil and Grease
- Chloroform
- 1,1,1 Trichloroethane
- Chromium
- Trichloroethene
- Xylene
- Acetone
- Trichloroethylene
- Naphthalene
- Toluene
- Methylene Chloride
- Phenanthrene

Darling Fertilizer

Darling was in the business of manufacturing chemical fertilizers. The process appears to have involved acidulation of phosphate rock and the subsequent blending of the rock with nitrates, lime, etc. The waste water from the plant contained phosphorus and nitrogen. Darling abandoned operations sometime after 1965.

Edwin Cooper & Company (now Ethyl)

Edwin Cooper & Company began operating in Sauget in 1969. Its sewer discharges included acid and oil.

Midwest Rubber

Midwest, located across the street from Site G, began operations in Sauget in 1928. The company reclaimed rubber, principally from discarded automobile tires by heating the ties in autoclaves with caustic solution or chloride solution. Midwest discharged waste directly into the creek through an effluent pipe into CS-B. Waste water would have contained pine tars, naphthalene and other substances such as zinc and waste oil. In 1971 sampling found rubber particles in the discharges as well as zinc. During sampling of waste waters of many Sauget area industries in 1971, it was found that Midwest's waste water flow contained 9 ppb PCBs.

Mobil

Predecessor corporations to Mobil began operation of a refinery in Sauget in 1917. Operations included the production and storage of typical petroleum refining products including a wide range of fuels such as gasoline, kerosene, fuel oils, and residual fuels, and heavier products such as base oils and coke. In 1970 the refinery operations shut down while the terminal operation remained. Wastewater was discharged daily into the Village sewer system plant when the refinery was in operation up to 1970, then intermittently when the fuels terminal was in operation. The wastewater was probably a combination of petroleum process water after primary separation, cooling water and storm water. Mobil's releases to the Village sewer ran down the "south trunk" which was the line that ran directly to the north of CS-A. A May 6, 1982 EPA memo states that Mobil was one of many industries discharging wastes into Dead Creek.

Contaminants in Mobil's waste water included:

- Phenols
- Ammonia nitrogen
- PCBs

Monsanto

From 1917 to 1997 the Monsanto Willliam G. Krummrich plant in Sauget was engaged in the manufacture of various inorganic and organic chemicals including adipic acid, alkylbenzene, benzyl chloride, butyl benzyl chloride, calcium benzene sulfonate, caustic soda, chlorine, chlorinated cyanuric acid, chlorophenols, monnchloroacetic acid, monochlorobenzene, 2,4-D, fatty acid chloride, muriatic acid, nitric acid, 4-nitrodiphenylamine, ortho-dichlorobenzene, ortho-nitrophenol, PCBs, para-dichlorobenzene, para-nitroaniline, para-nitrochlorobenzene, pentachlorophenol, phenol, phosphoric acid, phosphorous trichloride, phosphorus pentasulfide, potassium phenyl acetate, potash, Santoflex, Santomerse, Santolube 393, sulfuric acid, 2,4,5-T, tricresyl phosphate, zinc chloride . The waste water stream leaving the plant varied over the years, but may have contained the following:

- Nitric acid
- Sulfuric acid
- Hydrochloric acid
- Chlorine
- Chlorinated and nitrated aromatics

Rogers Cartage

Rogers Cartage owned and operated a fleet of tanker trucks. It hauled products for many companies in the metropolitan St. Louis area. During Rogers operations in Area 1, it washed out tanker trucks that had been used to transport product and some wastes for many of the industries in Sauget and the surrounding area. Trucks were washed with caustic solution.

Documentation in the file indicates that Rogers Cartage was a major user of the sewer system. It began using the sewer in 1969. Rinse water was discharged into the Village sewer south trunk which then traveled to the sewer connection at the north end of Dead Creek. Also, there was a 12 inch sewer overflow line that was located at the Rogers Cartage property and discharged directly into Dead Creek. It was installed sometime before 1965. This line was installed to allow relief of the northward traveling sewer line at times of heavy flow. Thus, this line would have caused truck washing waste water to discharge into Dead Creek. A Monsanto memo dated January 5, 1971 indicates that a significant quantity of PCBs in the Village sewer probably came from the Rogers Terminal.

The types of products Rogers hauled which were likely washed into the Village sewer including Dead Creek were:

- Orthonitrochlorobenzene
- Monochlorobenzene
- Orthodichlorobenzene
- Sulfuric Acid
- Maleic Anhydride
- Phosphorus Oxychloride
- Therminol
- Alkylbenzene
- muriatic acid
- Monochloroacetic Acid
- Aroclors
- Oleum
- $POCl_3$ (phosphorus oxychloride)
- PCl_3 (phosphorus trichloride)
- Phenol
- Petroleum and Oil Additives
- Zinc Sulphate solution
- Sulfuric Acid
- Phenol
- Acetone
- Toluene

- Benzene
- Xylene Mixtures

Sauget & Co.

Sauget & Co. operated a landfill at Site I for a number of years. IEPA has reported that waste from Site I would routinely overflow and leach into Dead Creek.

Sterling Steel

Sterling Steel began steel casting operations in the Sauget area in 1922. Wastes from this foundry included spent foundry sand, popcorn slag and quench water scale. Cooling water from electric furnaces, compressors and air conditioning was discharged into the 24-inch sewer line at the north end of Dead Creek. PCB-containing materials were commonly used in casting facilities for fire prevention.

Waggoner

Waggoner started operations on Site L in 1964. Waggoner owned/operated approximately 23 stainless steel trucks and a couple of rubber-lined trucks. It washed its trucks at Site L and drained the tank washings into Dead Creek. In addition, floor drains from the building went directly to Dead Creek. In June 14, 1965 meeting minutes for the Monsanto Village Plant Managers, the statement is made that Waggoner should be persuaded to cease dumping chemicals into Dead Creek. In an August 5, 1971 memo, IEPA states that tanker trucks labeled as corrosive were apparently discharging their contents to Dead Creek near Queeny Avenue. The Agency notified the company of the discharge and Waggoner responded that the discharges had been eliminated. After the IEPA required that discharges to CS-A cease, Waggoner excavated a pit which was used by Waggoner until 1974 when the company was sold to Ruan.

In 1973, the IEPA visited Waggoner and found that a hole had been dug nearby into which the tanker truck washwater discharged. Use of a second pit appears to have begun in 1973.

According to an IEPA memo drafted by Tim Murphy (1992 to USEPA) these pits were designed to overflow into Dead Creek.

Ruan reportedly continued using the pit until 1978. IEPA estimated that between 1971 and 1978, 164,000 gallons of wash water was disposed of in the pit. The pit was not lined and consisted of medium to coarse-grained sand.

The following materials were hauled by Waggoner and thus were likely washed into Dead Creek as rinsate from the truck washings:

- Phosphorous Trichloride
- Phosphorous Oxychloride
- Biphenyl
- Aroclors
- Pyranols
- Phenol
- Alkyl Benzene
- Petroleum Additives (including zinc dibutyldithiophosphate, alkylbenzene sulfonic acid, benzene, sulfonic acid)
- Chloryl acetyl chloride
- Muriatic acid
- Monochloroacetic acid
- Sulfuric Acid
- Chlorosulfuric Acid
- Santolubes
- Other Products handled: (IEPA 4/18/84 Dunn memo to Egan)
  - Chlorosufonic acid
  - Muric acid
  - Sulfuric acid
  - Oleum
  - Plasticizers
  - Caustic metal cleaners
  - Oil additives
  - Phosphoric acid
  - Phostri (commercial name)

5.1.3 Disposals At Sauget Area 1 Source Areas

Documentation of disposals at source areas in Sauget Area 1 is limited. While Monsanto has submitted information to the U.S. EPA that documents its disposals into Site I, no other area industry has presented such information despite the fact that many industries throughout the metropolitan area were using these sites. The following sets forth the limited knowledge available:

American Zinc (Amax)

A former Monsanto employee stated to IEPA that American Zinc dumped material in Sauget. It's waste included copper cake containing copper, nickel and cobalt.

Chemical Warfare Service

The CWS plant operated and owned by the government was in operation while Sites H and I were being used as landfills and possibly while dumping was occurring in Site G. Thus it is likely that wastes from this plant were disposed of in Sites G, H, and I.

Cerro Copper

Cerro used slag from its blast furnace as fill at Site I.

Darling Fertilizer

The Darling plant was operated from sometime in the early 1900s (it was in operation at least by 1929) until 1965. Based on this time frame and its location, it is highly likely that wastes from the Darling plant were disposed of in Sites G, H, and I.

Edwin Cooper

Edwin Cooper began operations in Sauget in 1969. It produced crankcase, gear and hydraulic lubricant additives. Its wastes included diatomaceous earth used to filter products.

Midwest Rubber

Midwest Rubber's wastes included rubber, pine tars and napthalene. Until 1965 Midwest burned rubber that adhered to wires present in tires. Burning ceased in 1965 and the residual was hauled away, possibly to Site G. EPA has found that tire combustion is a source of dioxin. In addition, combustion of tires at the site has caused dense smoke that contained lead, arsenic, cyanide, benzene, PAHs, ethyl mercaptan, etc. all of which are contaminants found in Sauget.

Midwest used PCBs in equipment on site. Waste PCB oil could have been disposed in Area 1.

Monsanto

Monsanto submitted a 103(c) notice in 1981 which identified the "Sauget (Monsanto) Landfill" on Falling Springs Road as receiving wastes from both the WGK plant and the Queeny plant in St. Louis from an unknown date until 1957. These notices indicate that the type of wastes disposed of in the landfill included organics, inorganics and solvents. Based on documents in Monsanto's 104(e) response the wastes disposed at this landfill were waste chemicals, residue, filter aid, waste paper, paper sacks, floor sweepings, garbage, cardboard, fiber packs, steel drums, scrap building materials etc. Because both the WGK and Queeny plants used other disposal sites for their wastes, exactly what was disposed of at the Sauget Area 1 landfills is unknown.

Mobil

In answers to a 104(e) request, Paul Sauget stated that Mobil disposed of material at one or more of sites G, H, and I. Mobil disposed of sludges and beads from its filtering operations. Mobil likely used PCBs in its processes since 54 ppb PCBs were found in Mobil's sewer effluent in 1971.

During the excavations at Site G, a large volume of oily sludges and tar-like wastes were found. Because of the volume, it appears that the material originated from a large refinery operation.

Rogers Cartage

Rogers Cartage owned and operated a portion of Site H from 1968 to 1979. Those operations likely resulted in the release of tank washings on to the ground at the site. The products hauled by Rogers Cartage are listed above.

Sterling Steel

Sterling Steel operated in Sauget from 1922 on. Its processes produced waste that included spent foundry sand and popcorn slag. The sand has been found to be EP toxic for metals

T.J. Moss/ Kerr McGee

From 1927 to1968, T.J. Moss operated a plant in Sauget that treated wood products such as railroad ties and utility poles, in a process that involved treating the wood with creosote, pentachlorophenol and other preservatives.

Operations at the plant under T.J. Moss and its successor Kerr-McGee ("KMCC") were essentially identical. The plant used creosote and "...5% Pentachlorophenol ("penta") in #2-4 diesel." Creosote solutions were utilized over the entire operating history of the plant. Penta was only used from the early 1950's until the plant's closing. Dry penta was used at a rate of 540 pounds per day, (or 1,300 gallons of 5% penta solution per day). In reports to IEPA, KMCC has stated that "assuming the plant treated with...PCP for 19 years (1950 through 1969) it would have consumed about...1300 tons of dry PCP (or 6.2 million gallons of 5% PCP solution)." Monsanto appears to have sold penta to T.J Moss. The facility also used grade #1

Creosote, creosote-coal tar solution and creosote-petroleum solution. Approximately 9,700 gallons of creosote solution were used per day.

Untreated wood waste was allegedly burned in the plant's boiler for heat recovery. Waste waters and storm waster were impounded on site. There is no indication in the report or elsewhere, where the remaining wastes from the site were disposed.

Creosote is a complex mixture of hundreds of individual PAH compounds plus minor amounts of phenolics. At least one of the reports KMCC has been required to submit to the state because of contamination on the KMCC property, sets forth a table summarizing reported analysis for PAH in creosote. Many of the listed PAH's have been found at all the Area 1 sites. In addition penta has been found at most, if not all the Area 1 sites.

Waggoner

Waggoner operated at Site L beginning in 1964. Where it operated before that date is unknown, but it may have washed tanks anywhere in Sauget. During its tank washing processes Waggoner discharged contaminated wash water onto the ground, into lagoons on site and into Dead Creek. A list of the materials hauled by Waggoner is set forth above.

Demolition Debris

There are various references in the Sauget documents that reference the disposal of demolition debris in Site I and possibly at other sites.

Other Disposals

There were numerous industries in the East St. Louis area in the 1940 to 1960 time frame. Any and all of these industries could have disposed of materials in Area 1. These industries included:

- Alcoa
- Certain Teed Corporation
- Eagle Picher Paints
- Lanson Chemical/Purex Corporation
- Morris Paints
- Pfizer Pigments
- Tudor Works

5.1.4 Analytical Parameter List

Based on this review of disposal practice histories, meetings and telephone conversations with USEPA, USACE, Weston and IEPA and a review of the 1998 Ecology and Environment report, the following analytical parameter list is considered appropriate for this SSP:

Volatile Organic Compounds	Method 8260B
Semivolatile Organic Compounds	Method 8270C
Metals	Method 6010B
Mercury	Method 7470A/7471A
Cyanide	Method 9010B
PCBs	Method 680
Pesticides	Method 8081A
Herbicides	Method 8151A
Dioxins	Method 8280/8290

5.2 Waste Depths

Four soil borings will be installed at each of Sites G, H, I, L and N and continuous soil samples will be collected from grade to two feet below the bottom of the fill material which is assumed to be 40 ft. below grade (Figures 2 and 3). Digital photographs of each soil sample will be taken in color against a scale to provide a record of materials present in each fill area (Sites G, H, I, L and N).

The 0 to 0.5 ft. soil sample from each sampling location will be analyzed for the following parameters and used in the Human Health Risk Assessment (Volume 1B):

Number of Soil Samples	20	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxins	Method 8280

One composite waste sample will be collected at each boring location and analyzed for waste disposal characteristics, VOCs, SVOCs, Metals, Mercury, Cyanide, Pesticides, Herbicides, PCBs and Dioxin. Visual observation and PID/FID readings will be used to identify whether or not waste is present in a continuous boring sample. If waste is present, it will be removed, segregated, temporarily stored and used at the completion of the soil boring to prepare a composite waste sample.

Since VOC samples can not be composited without losing volatiles, the waste sample with the highest PID/FID readings will be used for VOC analysis. The entire length of each core sample will be screened immediately upon retrieval from the sampler using a hand-held PID or FID instrument to identify the section of the sample with highest PIR/FID readings. Then the core section with the highest PID/FID reading will be excised and immediately stored in a labeled jar. The core section with the highest PIR/FID reading from each soil boring will be analyzed for VOCs.

Experience at Sauget Area 2 Site R indicates that fill depth is unlikely to be greater than 40 ft. If wastes are encountered at depths greater than 40 ft. bgs, borings will continue until the bottom of the fill is encountered.

Site M will be characterized by collecting four sediment samples at the preliminary locations shown on Figure 4.

Existing information, e.g. the 1988 Ecology and Environment report and the results of the air photo analysis, soil gas surveys and magnetometer surveys conducted as part of the SSP will be used to select boring locations.

Number of Waste Samples	24	
Waste Characterization	Ignitability	
	Corrosivity	
	Reactivity	
	TCLP	Method 1311
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxins	Method 8280

A two-inch diameter well, screened at the bottom of the fill material, will be installed at one waste characterization boring completed at Site G and one waste characterization boring completed at Site I to provide samples for leachate treatability testing.

Additional waste characterization borings may be required by the Agency as a result of variability in waste characteristics observed during the waste characterization boring program.

5.3 Extent of Cover Over Fill Areas

All available historical air photos not included in the 1988 Ecology and Environment report, will be obtained for Sites G, H, I, L and N. These photos, and the results of the E&E evaluation, will be used to define the areal extent of each site. Boundaries of the waste disposal areas will be defined using historical air photos to establish the areal extent of excavation and fill areas over time. For each photo, the boundaries of Sites G, H, I, L and N will be traced and input into a CADD file. To define the extent of fill, the CADD files will be overlain for each site and a line will be drawn around the outside boundary of the composite fill areas. If stereoscopic evaluation of historical air photographs allows identification of the deepest portion of the fill area, one of the four waste characterization borings will be done at that location.

Results of the analysis of historical air photos will be used to prepare a map for each site showing fill area boundaries and the final selected locations of the boundary confirmation trenches and the waste characterization borings. When the map for each fill area is completed, it will be submitted to the Agency for acceptance prior to performance of the boundary confirmation trenching or collection of the waste characterization samples. Boundary confirmation trenches and waste characterization borings will be located in the field by measuring from known points such as buildings, roads or other cultural features or by using GPS.

Preliminary boundary confirmation trench and waste characterization boring locations are shown on Figures 2 and 3. Test trenches will be used to confirm the boundaries of the fill areas identified through air photo analysis. One trench will be installed on each side of a fill area, a total of four trenches per site. Test trenches will start outside the defined boundary of the fill area and move toward the defined boundary. When fill materials are encountered, the fill area boundary will be compared to boundaries identified based on air photo analysis and considered confirmed. Trenching at that location will be terminated.

All excavated soil and fill material will be returned to the test trench with the exception of any intact drums which will be removed provided confined space entry is not needed to retrieve a drum. Trenches will not be entered to recover drums because of the danger inherent in such activities. Test trench locations will be determined using GPS and recorded for future reference in the event drum removal is appropriate. Recovered drums will be overpacked and stored pending disposal. Free product, solid waste and contaminated soil resulting from rupture of drums during removal will be cleaned up by absorbing any liquid materials and placing the spent absorbent, solid waste and contaminated soil in bulk containers at a controlled-access, fenced, investigation derived waste (IDW) storage area to be constructed north of Judith Lane adjacent to Dead Creek. Building permits for this facility were obtained in June and construction is scheduled to start in July. Overpacked drums will be also be stored at this facility. Recovered drums will be stored until the capacity of the storage pad is exceeded or the investigation is completed, whichever comes first. Drum and bulk container storage may be indefinite if the IDW contains materials that can not or will not be accepted by off-site disposal facilities, e.g. dioxin. Any waste excavated that identifies the source of material present in the fill area will be noted in the field log and photographed.

Number of Test Trenches	20

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Trenching equipment will be hired on a per day basis. If all or part of the planned 20 boundary trenches are finished before the end of a day, additional trenches will be installed at locations approved by the Agency for the remainder of the day provided these areas are covered by access agreements.

Time spent recovering drums will increase the duration of the Support Sampling Plan schedule on a one for one basis, i.e. one day spent removing drums will increase the Support Sampling Plan schedule by one day.

5.4 Waste Volumes

Waste volume will be determined using the areal extent information obtained from historical air photo analysis, boundary confirmation trenching and the depth of fill information obtained from the waste characterization borings at each site.

5.5 Soil Gas Survey

A soil gas survey will be conducted at Sites G, H, I, L and N using a shallow soil probe (5 ft.) and on-site analysis of collected vapors for VOCs. Soil gas samples will be collected at a frequency of one sample per acre. Each sample will be collected at the center point of each grid cell using the following grid spacings (Figures 5 and 6):

Site	Grid Size	Grid Spacing	Number of Samples
G	400 ft. by 600 ft.	200 ft by 200 ft.	6
H	400 ft. by 800 ft.	200 ft. by 200 ft.	8
I	400 ft. by 1200 ft.	200 ft. by 200 ft.	12
L	200 ft. by 200 ft.	200 ft. by 200 ft.	1
N	300 ft. by 300 ft.	200 ft. by 200 ft.	2
		Total Number of Samples	29

If detectable concentrations of VOCs are found in the fill area soil gas samples, the survey will be extended beyond the boundary of the fill area. Soil gas samples will be collected at 100 ft. intervals (0, 100 and 200 ft. from the edge of the fill area) along four 200 ft. long transects (three samples per transect); one transect perpendicular to each side of the fill area. If VOCs are detected in soil gas at each of the five fill areas, it is anticipated that as many as 60 additional soil gas samples may be collected:

Site	Number of Transects	Number of Samples
G	4	12
H	4	12
I	4	12
L	4	12
N	4	12
	Total Number of Samples	60

If twelve additional soil gas samples are not adequate to define the extent of VOC-containing soils associated with each fill area, additional soil gas samples will be collected at 100 ft. intervals along the four sampling transects at each fill area until the limits of the impacted fill are found. If soil gas surveys need to extend into areas for which there are no property access agreements, soil gas sampling will be suspended until access is obtained.

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

5.6 Buried Drum and Tank Identification

5.6.1 Magnetometer Surveys

Magnetometer surveys will be conducted at Sites G, H, I, L and N to identify anomalies indicative of drum disposal or buried tanks. To determine whether or not the anomalies are associated with buried drums or tanks, test trenches will be dug at: 1) anomalies that coincide with groundwater isoconcentrations greater than 10,000 ppb as identified by the 1998 Ecology and Environment Data Tables/Maps Report, 2) SVE anomalies detected during the soil gas survey, 3) magnetic anomalies identified by the 1988 Ecology & Environment geophysical surveys and 4) areas of drum or tank disposal identified during historical air photo analysis of fill area boundaries. Magnetometer measurements will be made at locations determined by superimposing a 50 ft. by 50 ft. grid on the fill areas:

Site	Grid Size	Grid Spacing	Measurements
G	400 ft. by 600 ft.	50 ft. by 50 ft.	96
H	400 ft. by 800 ft.	50 ft. by 50 ft.	128
I	400 ft. by 1200 ft.	50 ft. by 50 ft.	192
L	200 ft. by 200 ft.	50 ft. by 50 ft.	16
N	300 ft. by 300 ft.	50 ft. by 50 ft.	36
		Total Number of Measurements	468

Magnetometer measurement points will be located in the field by measuring from known points such as buildings, roads or other cultural features or by using GPS.

Existing information on plume concentration, combined with information from the soil gas survey, will be used in evaluating whether or not magnetic anomalies indicate the presence of buried drums or tanks. Fill areas in Sauget Area 1 were used for disposal of municipal and industrial waste as well as construction debris. Magnetic anomalies are likely to be numerous, intense and wide spread in the fill areas. It is appropriate to use a screening method to identify those anomalies that should be excavated to determine if they are due to buried drums or tanks. Comparing groundwater and soil gas concentration highs found at each fill area with corresponding magnetic anomalies at each fill area is a good method for selecting excavation locations within the fill areas provided groundwater and soil gas concentration highs have not migrated beyond the limits of the fill area. Coupling this information with prior geophysical surveys conducted by Ecology and Environment in 1988 and evaluation of historical air photo analysis to identify portions of the fill areas where drums or tanks were placed will allow selection of test trenching locations that focus on areas where tanks or large numbers of drums may be buried.

5.6.2 Test Trenches

If no excavation location criterion other than the presence of a magnetic anomaly is used to determine whether or not an excavation is appropriate, disturbance of a significant portion of each fill area is likely to result. Excessive trenching could result in unacceptable risks to the community, on-site workers and the environment at sites that currently appear to be stable.

Test trenches to confirm the presence of buried drums or tanks will be done at Sites G, H, I, L and N. Site G is a fill area stabilized by USEPA in an emergency response that solidified organic wastes, placed a temporary soil cover the site and controlled site access by installation of a fence. Recent inspection indicates the site is still stable. Site H is a grass field at the intersection of two major roads, Queeny Avenue and Falling Springs Road. It is across the street from the Cahokia Village Hall. Cinders are present at the surface in some areas of the site. Recent inspection indicates the site is stable with a vegetative cover and no wastes exposed at the surface. Commercial buildings and a self-storage facility are located on the site. Site L, which is covered with cinders, is located in a vegetated field and appears stable.

Site N is located at the rear of a former construction company site that is now occupied by what appears to be a sign company.. The stability of Site N could not be assessed because it was not visible from publicly accessible areas. Evidence of site clearing across the entire parcel was readily discernible from Falling Springs Road.

Test trenching will be done to confirm that the presence of buried drums or tanks can be determined using a combination of magnetic anomalies, air photo analysis and soil gas and groundwater data. One test trench will be conducted at the largest magnetic anomaly found at each site that coincides with: 1) drum/tank disposal locations identified by historical air photo analysis, 2) an area of high VOC concentrations in soil gas, 3) an area of high groundwater concentrations identified in the 1998 Ecology and Environment Sauget Area 1 Data Tables/Maps report or 4) major magnetic anomalies report in the 1988 Ecology and Environment Report "Expanded Site Investigation, Dead Creek Project Sites at Cahokia/Sauget, Illinois".

All excavated soil and fill material will be returned to the test trench with the exception of any intact drums which will be removed provided confined space entry is not needed to retrieve a drum. Trenches will not be entered to recover drums because of the danger inherent in such activities. Test trench locations will be determined using GPS and recorded for future reference in the event drum removal is appropriate. Recovered drums will be overpacked and stored pending disposal. Free product, solid waste and contaminated soil resulting from rupture of drums during removal will be cleaned up by absorbing any liquid materials and placing the spent absorbent, solid waste and contaminated soil in bulk containers at a controlled-access, fenced, IDW storage area to be constructed north of Judith Lane adjacent to Dead Creek. Building permits for this facility were obtained in June and construction is scheduled to start in July. Overpacked drums will be also be stored at this facility. Recovered drums will be stored until the capacity of the storage pad is exceeded or the investigation is completed, whichever comes first. Drum and bulk container storage may be indefinite if the IDW contains materials that can not or will not be accepted by off-site disposal facilities, e.g. dioxin. Any waste excavated that identifies the source of material present in the fill area will be noted in the field log and photographed.

Time spent recovering drums will increase the duration of the Support Sampling Plan schedule on a one for one basis, i.e. one day spent removing drums will increase the Support Sampling Plan schedule by one day.

Trenching to remove buried drums or tanks is an activity that should be done, if necessary, as part of a carefully planned removal action or when a remedy is implemented. Solutia is very concerned about the safety of workers, the community and the environment during test trenching and drum removal activities. One release to the atmosphere, which sent five workers to the hospital, occurred during an investigation conducted in Creek Segment A. During World War II, the United States government purchased 15 acres of Monsanto's W.G. Krummrich plant in Sauget, Illinois and built and operated the Chemical Warfare Plant. Solutia does not know what chemicals were used or produced by this facility. It is quite likely that raw materials, waste materials and finished product from the U.S. government's Chemical Warfare Service plant could be present in the fill areas located in Sauget Area 1. For this reason, Solutia believes intrusive activities at Sites G, H and I to identify buried drums and tanks should be kept to an absolute minimum if they are conducted at all. The inherent danger to workers, the public and the environment associated with drum removal activities, limited groundwater downgradient migration of constituents at Sites G, H and I and no downgradient groundwater users must be taken into account when considering drum and tank removal during the site investigation. If large numbers of intact drums are encountered and significant downgradient migration of constituents could occur if they were left in place until a remedy could be implemented, a carefully planned and executed removal action to stabilize the situation could be appropriate.

6.0 Groundwater Sampling Plan

Groundwater samples will be collected in the alluvial aquifer and bedrock at the fill areas, in the alluvial aquifer downgradient of the fill areas and in shallow groundwater and domestic wells adjacent to Dead Creek. The purpose of this sampling is to define current groundwater quality conditions at the source areas, to define the extent of migration away from the source areas and to provide information for the human health risk assessment (construction/utility worker exposure, vapor intrusion into buildings and residential use of groundwater from shallow wells for lawn and garden watering). The Human Health Risk Assessment Work Plan is in Volume 1B.

6.1 Degree of Hazard and Mobility of Constituents

Sample number, sample coordinates and all organic and inorganic constituents detected in groundwater during past investigations of Sauget Area 1 will be compiled into a GIS-compatible data base, along with data from the EE/CA and RI/FS Support Sampling Plan. Frequency of detection, average, maximum, minimum and 95% confidence interval concentrations will be compiled for each detected constituent. Constituent mobility and hazard will be assessed during the human health risk assessment (Volume 1B Human Health Risk Assessment of the SSP).

6.2 Recharge and Discharge Areas

Groundwater conditions in the American Bottoms have been studied extensively by the Illinois State Water Survey, Illinois State Geological Survey and the U.S. Geological Survey. Information from these studies will be used to define recharge and discharge areas.

Experience at Site R, and information from published reports on the American Bottoms aquifer, indicates that groundwater flow patterns in the study area are primarily controlled by the Mississippi River and, to a lesser degree, by Dead Creek. Both drainages run north/south and groundwater will flow toward them in an east/west direction. For groundwater to flow from

Sites G, H, I and N to residences located south of these sites, a strong, local perterbation of the flow system would be needed, for example a high capacity pumping well. Plumes associated with Sites G, H, I and L, as mapped by Ecology and Environment in 1998 (Appendix A), do not indicate any distortion of the plumes toward the residences on Walnut Street and Judith Lane. Intermittent pumping of domestic wells for gardening or lawn watering is unlikely to stress the aquifer enough to cause Constituents to migrate 500 feet cross gradient. Evaluation of historical information, as described in Section 6.3, will determine if high capacity industrial pumping occurred southwest of Site H.

To address Agency concerns that a southwesterly flow direction from the source areas to the residential areas south of Judith Lane and west of Dead Creek may exist, groundwater samples will be collected at three locations on a transect running from Site G to Judith Lane (see Section 6.5.2.3).

6.3 Regional and Local Flow Direction and Quality

Groundwater conditions in the American Bottoms have been studied extensively by the Illinois State Water Survey, Illinois State Geological Survey and the U.S. Geological Survey. Information from these studies will be used to define historical regional and local flow direction and quality. Dead Creek data compiled by Ecology and Environment in 1998 will be integrated into this evaluation.

As directed by the Agency, groundwater flow conditions at the source areas will be determined by installing nine piezometer clusters at the locations shown on Figure 7. Each piezomter cluster will consist of three small-diameter wells completed in the shallow, intermediate and deep portions of the alluvial aquifer. Water levels in each well will be measured quarterly for one year to define seasonal fluctuations in water-level elevations. Water levels in existing wells will also be measured. Water-level elevation maps will be prepared for each quarterly measurement round and included in the Support Sampling Plan Data Report.

6.4 Local Uses of Groundwater

State, county, city and village records will be searched to identify any potential groundwater users along Dead Creek. Domestic wells identified by Ecology and Environment are summarized below:

Owner	Street Address	Water Use	Depth
Allen	101 Walnut Street	Greenhouse	17 ft.
Ballet	3300 Falling Springs Road	Residential	20 ft.
Wright	100 Judith Lane	Residential	-
Settles	102 Judith Lane	Residential	-
Schmidt	104 Judith Lane	Residential	49
McDonald	109 Judith Lane	Residential	-
Lyerla	118 Edwards Street	Residential	-
Hayes	22 Cahokia Street	Residential	-
Baumeyer	24 Cahokia Street	Residential	-

Existing domestic well water quality data are included in Appendix B as directed by USACE. This information was obtained from the 1998 Ecology and Environment Volume 1, Sauget Area 1, Data Tables/Maps Report prepared for USEPA Region 5.

It is important to note that Cahokia and Sauget are served by a public water supply and that these and other homes in the area are served by the municipal water supply system. Both Cahokia and Sauget are believed to have ordinances restricting groundwater use.

6.5 Horizontal and Vertical Distribution of Constituents

Ecology and Environment (1998) defined the areal extent of VOCs and SVOCs in shallow groundwater at Sites G, H, I and L. These plumes have migrated several hundred feet downgradient from disposal sites that were used from the 1930s to the 1970s. Plume shape indicates VOC and SVOC migration is toward the Mississippi River, which is the discharge point for the American Bottoms aquifer. Ecology and Environment did not collect information on COC distribution in the intermediate and deep portions of the aquifer.

Aquifer saturated thickness in the study area is on the order of 80 to 100 ft., perhaps more. A vertical groundwater sampling interval of 20 ft. would result in 4 to 5 groundwater samples per sampling station. A vertical sampling interval of 5 ft. would result in 16 to 20 samples per sampling station. Experience with similar hydrogeologic conditions to those found at Sauget Area 1 indicates that leachate migration from the fill areas should produce plumes with a vertical dimension of more than 5 ft. because the source areas are 30 to more than 50 years old and the aquifer is thick, highly permeable and homogeneous. Under these conditions, plumes are likely to have a vertical dimension of at least 20 ft. if not more. For this reason, a vertical sampling interval of 20 ft. is considered appropriate. However, in order to address Agency concerns about adequate characterization of the plumes, vertical groundwater samples will be collected every 10 ft.

6.5.1 Fill Area Groundwater

6.5.1.1 Shallow Groundwater

As directed by the Agency in its March 19, 1999 comments on the SSP, groundwater concentrations at the source areas will be determined by sampling existing Ecology and Environment wells (Appendix B) EE-01, EE-02, EE-03, EE-04, EE-05, EE-12, EE-13, EE-14, EE-15, EE-20, EEG-101, EEG-102, EEG-103, EEG-104, EEG-105, EEG-106, EEG-107, EEG-108, EEG-109, EEG-110, EEG-111 and EEG-112. Each well will be located, checked for integrity of surface seals, plumbed for depth and matched against construction records, redeveloped to remove accumulated fine-grained materials and promote groundwater entry into the well and sampled to provide data on current groundwater conditions at the source areas. If some or all of these wells no longer exist or can not be sampled, groundwater samples will be collected at the depth of the former screened interval using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques.

The location and purpose of sampling these wells are summarized below:

Site	Source Area or Downgradient Well	Shallow Groundwater Background Well	Screen Depth (ft bgs)
Site G	EE-05		18 -23
	EEG-101		18 - 23
	EEG-102		16.5 - 21.5
	EEG-104		19 - 24
	EEG-106		18 -23
	EEG-107		23 - 28
	EEG-112		21 - 26
Site H	EE-01		28 - 33
	EE-02		18 -23
	EE-03		27 - 32
		EE-04	18 -23
	EEG-110		18 - 23
Site I	EE-12		28 - 33
	EE-13		23 - 28
	EE-14		32.5 - 37.5
	EE-15		24 - 29
		EE-20	23 - 28
Site L	EEG-103		16.5 - 21.5
	EEG-105		No Construction Log
	EEG-109		17.5 - 22.55
South of Site G	EEG-111		No Construction Log
		EEG-108	24 - 29

Background groundwater samples will be obtained from the middle and bottom of the aquifer at the location of existing wells EE-04, EE-20 and EEG-108 as described in Section 6.12

Number of Groundwater Samples	19	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A

Herbicides	Method 8151A
Dioxin	Method 8290

6.5.1.2 Alluvial Aquifer Groundwater

As directed by the Agency, one alluvial aquifer saturated-thickness sampling station will be located at the groundwater concentration high at Site H and one alluvial aquifer saturated-thickness sampling station will be located at the groundwater concentration high at Site I (Figure 7). If available records or historical air photographs indicate the location of dredge spoil from Creek Segment A, the Site I alluvial aquifer saturated thickness sampling station will be placed at the location of this spoil instead of at the groundwater concentration high as directed by USACE. Groundwater samples will be collected at this location in order to determine the vertical extent of organic and inorganic constituents migrating away from Sites H and I.

Telescoping surface casing will be installed to a depth of 5 ft. and 20 ft. below the fill material in order to minimize carry-down of site-related constituents during groundwater sample collection. This casing will be grouted from the bottom up after completion of sampling.

Groundwater samples will be collected every 10 ft. from bottom of the surface casing to bedrock, which are assumed to be 60 and 100 ft. deep, respectively, using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques.

Number of Groundwater Samples 8

Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.1.3 Bedrock Groundwater

As directed by the Agency, one bedrock well will be installed in the middle of Sites G, H and I in order to determine the vertical extent of organic and inorganic constituents migrating away from these sites. Telescoping surface casing will be installed to a depth of 5 ft. and 20 ft. below the fill material and 5 ft. into bedrock in order to minimize carry-down of site-related constituents during groundwater sample collection and vertical migration of site-related constituents after completion of sampling.

Bedrock will be cored to a depth of 20 ft. below the telescoping casing. Cores will be digitally photographed in color against a scale and evaluated for porosity by examination and petrographic thin sections. A groundwater sample will be collected from each core hole.

Sampling locations will be based on the fill area shallow groundwater sampling results (Section 6.5.1.1).

Number of Groundwater Samples 3

Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.2 Downgradient Alluvial Aquifer Groundwater

6.5.2.1 Sites G, H and L

The horizontal and vertical extent of organic and inorganic constituents migrating away from Sites G, H and L and toward the Mississippi River will be determined by collecting samples at three sampling stations located along a transect between the maximum shallow groundwater concentrations at Site G and Route 3 (Figure 7). Groundwater samples will be collected every 10 ft. from the water table to bedrock, which is assumed to be 100 ft. deep, using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques.

Experience at other sites indicates this push sampling technology such as Geoprobe™ can reach depths of 60 ft. Depth of penetration can be increased at some locations by loosening the soil above the sampling horizon with a small-diameter solid stem auger before pushing the sampling probe to the required sampling depth. When the Geoprobe™ sampler or equivalent sampling technology can not penetrate to the required sampling depth, MicroWells™ will be used to collect groundwater samples. These small-diameter wells are vibrated into place using a small vibratory hammer. Experience in deep aquifers at other sites indicates that sampling depths of 100 ft. can be achieved. If the required sampling depths can not be reached with either of these two technologies, conventional percussion drilling equipment will be used to drive 1-1/4 inch diameter drive points to the required sampling depths.

Number of Groundwater Samples	30	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A

Cyanide	Method 9010B
PCBs	Method 680
Pesticides	Method 8081A
Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.2.2 Site I

The horizontal and vertical extent of organic and inorganic constituents migrating away from Site I and toward the Mississippi River will be determined by collecting samples at three sampling stations located along a transect between the maximum shallow groundwater concentrations at Site I and Route 3 (Figure 7). Groundwater samples will be collected every 10 ft. from the water table to bedrock, which is assumed to be 100 ft. deep, using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques.

Number of Groundwater Samples	30	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.2.3 Areas Southwest of Sites G, H, I and L

The horizontal and vertical extent of organic and inorganic constituents migrating away from Sites G, H, I and L and moving in a southwesterly direction will be determined by collecting samples at three sampling stations located along a transect between the maximum shallow groundwater concentrations in Site G and Judith Lane (Figure 7). Groundwater samples will be collected every 10 ft. from the water table to bedrock, which is assumed to be 100 ft. deep, using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques.

Number of Groundwater Samples	30	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.2.4 Dioxin Sampling

Presence or absence of dioxin in groundwater migrating away from Sites G, H, I and L will be determined by analyzing samples from the shallow (20 ft. bgs), intermediate (60 ft. bgs) and deep (100 ft. bgs) portions of the alluvial aquifer at each of the three sampling stations downgradient of Sites G, H and L, each of the three sampling stations downgradient of Site I and each of the three sampling stations southwest of Sites G, H, I and L. Samples will be collected concurrently with the VOC, SVOC, Metals, Mercury, Cyanide, PCB, Pesticide and Herbicide samples described above.

Number of Groundwater Samples	27	
Analyses	Dioxin	Method 8290

6.5.3 Bedrock Groundwater

See Section 6.5.1.3.

6.5.4 Domestic Wells

6.5.4.1 Shallow Groundwater

Ecology and Environment (1998) identified several homes on Walnut Street and Judith Lane with private water wells. Shallow groundwater samples will be collected at two sampling stations to determine if site-related constituents are migrating from Dead Creek toward these domestic wells (Figure 7). One sampling station will be located at the end of Walnut Street and the other sampling station will be located on the east bank of Dead Creek at Judith Lane. Groundwater samples will be collected at the water table and at depths of 20 and 40 ft. below ground surface which bracket the typical completion depth of domestic wells in southern Illinois. Push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques will be used to collect six groundwater samples.

Number of Groundwater Samples	6	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.4.2 Time-Series Sampling

After collection and analysis of the shallow groundwater vertical-profile samples at Walnut Street and Judith Lane, one MicroWell™ will be installed at each sampling station with its screened interval in the zone of highest detected constituent concentrations. USACE required stressing the aquifer at this sampling location. Time series samples will be collected over a 24-hour period with samples collected at 0, 12 and 24 hours after the start of pumping in order to stress the saturated zone during sampling and determine constituent concentration trends. Pumping rates can not be determined in advance but will be set so that the MicroWell™ can be pumped continuously for 24 hours without drying up.

Number of Groundwater Samples	6	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.5.4.3 Domestic Wells

Groundwater samples will be collected from a total of four domestic wells on Walnut Street and Judith Lane that could be used for irrigation or drinking water supply. Preference will be given to sampling wells that were sampled in the past by IEPA in order to provide some degree of historical record. Past domestic well sampling results, extracted from the 1998 Ecology and

Environment report "Volume 1, Sauget Area 1, Data Tables/Maps" are included in Appendix B as directed by USACE.

Number of Groundwater Samples	4	
Analyses	VOCs	Method 8260
	SVOCs	Method 8270
	Metals	Method 6010
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

6.6 Slug Tests

A considerable amount of information on the hydraulic characteristics of the American Bottoms aquifer is available from the Illinois Water Survey, Illinois Geological Survey and US Geological Survey. Public information, augmented by site-specific slug tests, may be all that is needed to design a pump and treat system should such a remedial measure be selected for a site. Performance of a pumping test on a high yield aquifer creates practical problems such as storage, treatment and disposal of large volumes of pumped water. When it is necessary to design a pump and treat system, it may be simpler to use the best available information to design the recovery and treatment system and then add more recovery wells and treatment capacity if the system does not perform as expected. For these reasons, slug testing was selected as the preferred method for determining site-specific aquifer hydraulic characteristics.

Three slug tests will be collected at each fill area (Sites G, H, I, L and N) to determine aquifer hydraulic conductivity. Slug tests will be conducted in the upper, fine-grained zone, the middle fine sand zone and the lower coarse sand zone typical of the American Bottoms aquifer in this area.

Number of Slug Tests 15

6.7 Grain Size Analyses

One soil boring will be completed adjacent to each fill area (Sites G, H, I, L and N) and soil samples will be collected from the upper, middle and lower aquifer zones using a Geoprobe™ or other suitable push technology. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Each soil sample will be analyzed for grain size.

Number of Grain Size Analyses 15

6.8 Upgradient Samples

Existing wells EE-20, EE-04 and EEG-108 will be used as background (upgradient) groundwater sampling locations. These wells, which are screened at depths of 23 - 28, 18 - 23, 24 -29 ft below ground surface, respectively, will be redeveloped as described in Section 6.5.1.1. If these wells cannot be used, Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology will be used to collect samples from the center of the former screened intervals at each of these locations using low-flow sampling techniques. In addition, groundwater samples will be at depths of 60 and 100 ft. below grade surface at each of these locations using push sampling technologies such as Geoprobe™, HydroPunch™, MicroWell™, Waterloo Profiler™ or equivalent sampling technology and low-flow sampling techniques. A sampling depth of 60 ft. is approximately the midway between the screened interval of the existing shallow wells and the bottom of the aquifer which is anticipated to be approximately 100 ft. deep.

Number of Groundwater Samples 9

Analyses	VOCs	Method 8260
	SVOCs	Method 8270
	Metals	Method 6010
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.0 Soil Sampling Plan

Soil samples will be collected in both undeveloped and developed areas that are susceptible to flooding and deposition of wind-blown dust. Specifically, floodplain soil sampling will be done in an area bounded by Queeny Road on the north, Falling Springs Road on the east, Route 157 on the south and Route 3 (Mississippi Avenue) on the west. This is the area where water backs up at road crossings during heavy rains and where PCBs are known to occur in creek sediments. This area also includes most of the residential development in Sauget Area 1.

Information from the soil sampling program will be used to determine the extent of migration due to overbank flooding and wind-blown dust deposition. In addition, surficial and subsurface soil information will be used in the human health risk assessment (construction/utility worker and residential exposure scenarios). The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP.

Floodplain soil samples will be collected every 200 ft. on seven transects in undeveloped areas, a total of 45 sampling stations. Based on these sampling results, twenty soil sampling stations will be located in developed areas. Three samples will be collected in developed areas adjacent to Transects 1, 2, 3, 4, 5 and 6 and two samples will be collected in developed areas adjacent to Transect 7 which is the transect at the downgradient limit of the residential area. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Twenty developed area samples are considered an appropriate number for identification in this SSP until undeveloped area soil samples and Creek Segment B, C, D and E sediment samples are collected and analyzed. Then information on the extent and concentration of constituents in undeveloped area floodplain soils and creek sediments can be used for final selection of developed area sampling locations.

7.1 Extent of Contamination in Undeveloped Area Surface Soils

Surficial (0 to 0.5 ft.) soil samples will be collected every 200 ft. on seven transects perpendicular to Dead Creek to determine the extent of migration via the surface water (overbank flow) and air (wind blown dust) pathways (Figure 8). Sampling transects are placed in undeveloped areas adjacent to developed areas to allow ready access for sampling.

Transect	Length (feet)		Number of Sampling Stations	Number of Surficial Soil Samples	Number of Subsurface Soil Samples
1	1300		7	7	7
2	1000		6	6	6
3	1300		7	7	7
4	1300		7	7	7
5	1000		6	6	6
6	800		5	5	5
7	1200		7	7	7
		Total	45	45	45

Number of Undeveloped Area Surficial Soil Samples	45	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.2 Extent of Contamination in Undeveloped Area Subsurface Soils

Subsurface (0.5 to 6 ft.) soil samples will be collected every 200 ft. on seven transects perpendicular to Dead Creek to determine the extent of migration via the surface water (overbank flow) and air (wind blown dust) pathways (Figure 8). Subsurface soil samples will be collected from 0.5 ft to 6 ft below ground surface. Visual observation of discoloration and field PID/FID readings will be used to identify the most impacted portion of the sample which will be selected for chemical analysis. Discoloration indicates the presence or organic and/or inorganic constituents and PID/FID readings indicate the presence of volatile organics. Surface and subsurface soil sampling stations will be co-located.

Number of Undeveloped Area Subsurface Soil Samples	45	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.3 Extent of Contamination in Developed Area Surface Soil Samples

Surficial soil samples (0 to 0.5 ft below ground surface) will be collected in at least 20 locations in developed areas. Soil samples will be collected at three residences adjacent to Transects 1 to 6 and at two residences adjacent to Transect 7.

Number of Developed Area Surface Soil Samples	20	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8280

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.4 Extent of Contamination in Developed Area Subsurface Soil Samples

Subsurface soil samples (0.5 to 6 ft below ground surface) will be collected in at least 20 locations in developed areas. Soil samples will be collected at three residences adjacent to Transects 1 to 6 and at two residences adjacent to Transect 7. Visual observation of discoloration and field PID/FID readings will be used to identify the most impacted portion of the sample which will be selected for chemical analysis. Discoloration indicates the presence or organic and/or inorganic constituents and PID/FID readings indicate the presence of volatile organics.

Number of Developed Area Subsurface Soil Samples	20	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.5 Dioxin Sampling

To provide information for the human health risk assessment (construction/utility worker exposure), the Agency directed that 20 percent of the subsurface soil samples will be analyzed for dioxin. As directed by USACE, 20% of the surface soil samples will be analyzed for dioxin. Visual observation of discoloration and field PID/FID readings will be used to identify the most impacted portion of the sample which will be selected for chemical analysis. Discoloration indicates the presence or organic and/or inorganic constituents and PID/FID readings indicate the presence of volatile organics.

Number of Surface Soil Dioxin Samples	13	
Number of Subsurface Soil Dioxin Samples	13	
Total Number of Analyses	26	
Analyses	Dioxin	Method 8280

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.6 Background Soil Samples

Background soil samples will be collected at the locations of the background groundwater wells, specifically existing wells EE-20, EE-04 and EEG-108 which are east of Sites I, H and L, respectively. Samples will be collected from a depth of 0 to 0.5 ft. and 0.5 to 6 ft. below ground surface.

Number of Background Soil Samples	6	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8280

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

7.7 Leachate Samples from Fill Areas

One leachate sample will be collected from Site I and one leachate sample will be collected from Site G using the 2-inch diameter well installed during the waste characterization program completed at each of these fill areas. As directed by USACE, these wells will be stressed so that a representative leachate sample can be collected. Wells will be pumped at a rate that allows continuous discharge without drying up the well and enough volume will be pumped to ensure that water from at least a foot away from the filter pack is drawn into the well before a sample is collected. For an 8-inch diameter borehole, a two-foot long screen and a porosity of 0.3, this amounts to approximately 25 gallons of leachate.

Pumping will be limited by constraints imposed by leachate storage and disposal requirements. These samples will be used in the leachate treatability pilot tests.

7.8 Soil Sampling of Residential/Commercial Areas Adjacent to Dead Creek

See Sections 7.1 through 7.5 above.

8.0 Sediment Sampling Plan

Vertically-integrated sediment samples will be collected in Dead Creek to determine the extent of downstream migration of site-related constituents and to provide information for use in the human health risk assessment (recreational teenager and recreational fishing scenarios) and the ecological risk assessment (endpoint organism exposure to sediments). The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP and the Ecological Risk Assessment Work Plan is in Volume 1C.

As directed by the Agency, sediment samples will be collected at 200 ft. intervals in the undeveloped portions of Dead Creek, i.e. Creek Segments B and F, and at 150 ft. intervals in the developed portions of Dead Creek, specifically Creek Segments C, D and E to determine the extent of migration of industry-specific constituents. A 150 ft. sediment sampling interval was used in the 1991 Geraghty & Miller investigation of Creek Segment B so repeating sample collection at an 150 ft. interval is not considered appropriate in this creek segment even though its southern end passes through a developed area. For this reason, sediment samples will be collected at 200 ft. intervals in Creek Segment B.

Sediment samples will be collected every 1,000 ft. in Dead Creek to determine the extent of migration of site-related constituents.

As directed by USACE, sediment sampling locations in Creek Segments B, C, D, E and the portion of Creek Segment F upstream of the Borrow Pit Lake will be adjusted in the field so that samples are obtained from the upstream and downstream ends of each road culvert at a specified radial distance from the culvert. Samples will be collected within a radial distance of ten feet from the upstream and downstream ends of each road culvert.

The extent of migration information collected as part of this task, coupled with sediment thickness measurements and channel cross sectional area, will provide enough information to determine volume of impacted sediments.

Sediment samples will not be collected in Creek Segment A. This creek segment was used as a storm water detention basin which was dredged a number of times to remove accumulated sediment. Dredge spoil was placed on the creek banks and in Site I. Cerro Copper performed an IEPA-approved remedial action for Creek Segment A in 1990 and 1991. Approximately 20,000 cubic yards of Impacted sediments were excavated from depths of 10 to 15 feet below grade and transported off site for disposal at the Waste Management landfill in Emelle, Alabama. After excavation, an HDPE vapor barrier was installed and Creek Segment A was backfilled. The site is now fenced and used as a controlled-access truck parking lot. Since Creek Segment A was remediated under an agreement with IEPA, no further characterization is considered necessary.

8.1 Extent of Industry-Specific Constituent Migration in Undeveloped Areas

Vertically-integrated sediment core samples will be collected at 200 ft. intervals in Creek Segment B and Creek Segment F to determine the extent of downstream migration of constituents related to specific industrial sources located at the upstream end of Dead Creek (Figure 9). The combined length of these creek segments is approximately 10,000 ft. Industry-specific constituents include PCBs (discontinued chemical manufacturing operation), Total Petroleum Hydrocarbons (closed oil refinery), Copper (active metal refining) and zinc (active metal refining). This information will also be used in the human health risk assessment.

Samples will be collected in depositional areas at the thickest sediment profile. Channel cross section will be surveyed at each sampling station and sediment depth will be measured at three (3) locations perpendicular to the channel (channel center and half way between channel center and right channel edge and half way between channel center and left channel edge).

Number of Sediment Samples	50	
Analyses	PCBs	Method 680
	TPH	Method 8015B
	Copper	Method 7211

Zinc	Method 7951
TOC	
Grain Size	
Solids Content	

Savannah Laboratories, which will perform the sediment analyses, does not have a procedure in their QAPP for analyzing zinc by AA. Savannah has all the necessary equipment to conduct this analysis but does not have the necessary lamp. This lamp will be obtained prior to start of sample analysis.

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

8.2 Extent of Industry-Specific Constituent Migration in Developed Areas

Vertically-integrated sediment core samples will be collected at 150 ft. intervals in Creek Segments C, D and E to determine the extent of downstream migration of constituents related to specific industrial sources located at the upstream end of Dead Creek (Figure 9). The combined length of these creek segments is approximately 7,000 ft.. Industry-specific constituents include PCBs (discontinued chemical manufacturing operation), Total Petroleum Hydrocarbons (closed oil refinery), Copper (active metal refining) and zinc (active metal refining). This information will also be used in the human health risk assessment.

Samples will be collected in depositional areas at the thickest sediment profile. Channel cross section will be surveyed at each sampling station and sediment depth will be measured at three (3) locations perpendicular to the channel (channel center and half way between channel center and right channel edge and half way between channel center and left channel edge).

Number of Sediment Samples	47	
Analyses	PCBs	Method 680
	TPH	Method 8015B
	Copper	Method 7211

Zinc	Method 7951
TOC	
Grain Size	
Solids Content	

Savannah Laboratories, which will perform the sediment analyses, does not have a procedure in their QAPP for analyzing zinc by AA. Savannah has all the necessary equipment to conduct this analysis but does not have the necessary lamp. This lamp will be obtained prior to start of sample analysis.

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

8.3 Extent of Industry-Specific Constituent Migration in the Borrow Pit Lake

Vertically-integrated sediment core samples will be collected at 400 ft. intervals from the upstream end of the borrow pit lake in Creek Segment F down to the confluence of Dead Creek with the lake in order to determine the distribution of constituents related to specific industrial sources located at the upstream end of Dead Creek (Figure 9). Industry-specific constituents include PCBs (discontinued chemical manufacturing operation), Total Petroleum Hydrocarbons (closed oil refinery), Copper (active metal refining) and zinc (active metal refining). This information will also be used in the human health risk assessment.

Samples will be collected along the center line of the lake. While sediment deposition is likely at the point where Dead Creek enters the Borrow Pit Lake, sediment transport north of the confluence will be limited by backwater depositional processes and streamflow into the north end of the lake.

Number of Sediment Samples	8	
Analyses	PCBs	Method 680
	TPH	Method 8015B
	Copper	Method 7211

Zinc	Method 7951
TOC	
Grain Size	
Solids Content	

Savannah Laboratories, which will perform the sediment analyses, does not have a procedure in their QAPP for analyzing zinc by AA. Savannah has all the necessary equipment to conduct this analysis but does not have the necessary lamp. This lamp will be obtained prior to start of sample analysis.

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

8.4 Extent of Site-Specific Constituent Migration in Dead Creek

Vertically-integrated sediment core samples will be collected every 1000 ft. in Dead Creek, from the upstream end of Creek Segment B to the downstream end of Creek Segment F at the Old Prairie du Pont Creek lift station, to determine the extent of downstream migration of TCL/TAL constituents (Figure 10). These broad-scan analyses are also intended to provide information for the human health and ecological risk assessments.

Two sediment core samples will be collected in the borrow pit lake in Creek Segment F upstream of the discharge of Dead Creek to assess the effect of backwater conditions and/or the contributions of other sources. One sample will be collected upstream and one sample will be collected downstream of the confluence of Dead Creek and Old Prairie du Pont Creek to determine the impact of the Dead Creek discharge on sediment quality in Old Prairie du Pont Creek.

The location of the upstream sample in Old Prairie du Pont Creek will be collected at an appropriate distance from the confluence with Dead Creek so that possible previous effects of flooding and flow reversals will not affect the collection of the background sample. As reported in the 1996 HRS package prepared by PRC Environmental Management, Inc. for USEPA, a background sampling station was located 200 ft. north of the confluence of Dead Creek and Old Prairie du Pont Creek. The sediment background sample will be collected at this location.

Samples will be collected in depositional areas at the thickest sediment profile. Channel cross section will be surveyed at each sampling station and sediment depth will be measured at three (3) locations perpendicular to the channel (channel center and half way between channel center and right channel edge and half way between channel center and left channel edge.

Number of Sediment Samples	20	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290
	TOC	
	Grain Size	
	Solids Content	

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

9.0 Surface Water Sampling Plan

Surface water samples will be collected to determine the extent of downstream migration of site-related constituents and to provide information for use in the human health risk assessment (recreational teenager and recreational fishing scenarios) and the ecological risk assessment (endpoint organism exposure to surface water). The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP and the Ecological Risk Assessment Work Plan is in Volume 1B.

9.1 Areas of Surface Water Contamination in Dead Creek and its Tributaries and Surrounding Wetland Areas

Surface water samples will be collected every 1000 ft. in Dead Creek, from the upstream end of Segment B to the downstream end of Segment F at the Old Prairie du Pont Creek lift station, to determine the extent of downstream migration of site-related constituents (Figure 10).

Two surface water samples will be collected in the borrow pit lake in Creek Segment F upstream of the discharge of Dead Creek to assess the effect of backwater conditions and/or the contributions of other sources. One sample will be collected upstream and one sample will be collected downstream of the confluence of Dead Creek and Old Prairie du Pont Creek to determine the impact of the Dead Creek discharge on surface water quality in Old Prairie du Pont Creek.

The location of the upstream sample in Old Prairie du Pont Creek will be collected at an appropriate distance from the confluence with Dead Creek so that possible previous effects of flooding and flow reversals will not affect the collection of the background sample. As reported in the 1996 HRS package prepared by PRC Environmental Management, Inc. for USEPA, a background sampling station was located 200 ft. north of the confluence of Dead Creek and Old Prairie du Pont Creek. The surface water background sample will be collected at this location.

Samples will be collected at a depth of 0.6 of the water column (measured from the top of the water column).

Number of Surface Water Samples	20	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010A
	Mercury	Method 7470A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290
	TSS	
	TDS	
	Hardness	
	pH	
	Fluoride	
	Total Phosphate	
	Orthophosphate	

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

10.0 Air Sampling Plan

Ambient air sampling will be conducted to determine the tendency of site constituents to enter the atmosphere and local wind patterns. Air sampling data will be used in the human health risk assessment (construction/utility worker and residential exposure scenarios). The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP.

10.1 Tendency of Constituents to Enter the Atmosphere and Local Wind Patterns

10.1.1 Volatile Organics

24-hour cumulative duration sorbent tube samples will be collected on a warm, dry day using TO1 sampling protocols in order to determine the tendency of site constituents to enter the atmosphere and local wind patterns. Two upwind and two downwind sorbent tube samplers will be installed around Site G and three upwind and six downwind sorbent tube samplers will be installed at Sites H, I and L. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Samples are not being collected at Site N because it is a construction debris disposal site.

Number of Volatile Organic Air Samples	13	
Analyses	VOCs	8260B

10.1.2 Semivolatile Organics, PCBs and Dioxins

24-hour cumulative duration PUF samples will be collected on a warm, dry day in order to determine the tendency of site constituents to enter the atmosphere and local wind patterns. Two upwind and two downwind PUF samplers will be installed around Site G and three upwind and six downwind PUF samplers will be installed at Sites H, I and L. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Samples are not being collected at Site N because it is a construction debris disposal site.

Number of Organic Air Samples	13	
Analyses	SVOCs	T0-13
	PCBs	TO-4
	Dioxin	TO-9

10.1.3 Metals

24-hour cumulative duration PM 2.5 samples will be collected over a 7 day period in order to determine the tendency of site constituents to enter the atmosphere and local wind patterns. Two upwind and two downwind PM 2.5 samplers will be installed around Site G and three upwind and six downwind PM 2.5 samplers will be installed at Sites H, I and L. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Samples are not being collected at Site N because it is a construction debris disposal site.

Number of Metals Air Samples	13	
Analyses	Metals	6010B

10.2 Degree of Hazard

All detected organic and inorganic constituents detected will be compiled into a data base. Frequency of detection, average, maximum, minimum and 95% confidence interval concentrations will be compiled for each detected constituent along with information on degree of hazard. This information will be used in the human health risk assessment. The Human Health Risk Assessment Work Plan is in Volume 1B of the SSP.

11.0 Ecological Assessment Sampling Plan

Data from the Ecological Assessment Sampling Plan will be used to evaluate the impact of site-related constituents on the following assessment endpoint organisms: large mouth bass, great blue heron, bald eagle, mallard duck, muskrat and river otter. The Ecological Risk Assessment Work Plan (Volume 1C of the SSP) and QAPP/FSP (Volume 3 of the SSP), describes how ecological sampling will be performed and how data will be used to assess impacts on assessment endpoint organisms.

VOC analysis is not included in the ecological assessment, except in the two reference areas, because VOC concentration in surface water and sediment is being determined as part of Sections 8.0 and 9.0 of the SSP, respectively. In addition, the benthic organism, vegetation, crawfish and fish samples are composites and VOC analyses can not be done on composites.

Fish sampling is focused on Creek Segment F because the Borrow Pit Lake at the southern end of this creek segment appears to be the best habitat area for fish and wildlife, it is most likely to be the primary depositional area for sediments transported from the upper reaches of Dead Creek and recreational fishing is most likely to occur at this location. Fish sampling is not proposed for Creek Segments B, C, D and E and the stream portion of Creek Segment F between Route 157 and the Borrow Pit Lake because these segments are essentially a storm water drainage channel in a densely settled area where streamflow is intermittent and habitat is limited. As directed by USACE, if fish are observed in Creek Segments B, C, D, E or the stream portion of F, one composite sample consisting of at least five forager fish will be prepared for each segment in which fish are found and analyzed for the following parameters:

Number of Composite Forager Fish Samples		5 (Whole Fish)	
	Total Number of Analyses	5	
Analyses		SVOCs	Method 8270C
		Metals	Method 6010B
		Mercury	Method 7471A
		Cyanide	Method 9010B

PCBs	Method 680
Pesticides	Method 8081A
Herbicides	Method 8151A
Dioxin	Method 8290

Fish will be sampled in areas with constituents that have a high bioaccumulation factor, e.g. PCBs, if data are available to identify these areas. If data are not available, fish will be collected over the entire length of the creek segment.

As directed by Weston, if crawfish are observed in Creek Segments B, C, D, E or the stream portion of F, one composite sample consisting of at least five crawfish will be prepared for each segment in which crawfish are found and analyzed for the following parameters:

Number of Composite Crawfish Samples	5 (Whole Crawfish)	
Total Number of Analyses	5	
Analyses	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

Crawfish will be sampled in areas with constituents that have a high bioaccumulation factor, e.g. PCBs, if data are available to identify these areas. If data are not available, crawfish will be collected over the entire length of the creek segment.

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

Fish sampling stations in the Borrow Pit Lake will be co-located with sediment sampling stations.

11.1 Affected Ecosystem Description

A habitat assessment will be conducted by assembling information from published and public sources on wetlands, special habitats, cover types and areal extent, lists of vegetation and fauna (terrestrial and aquatic) present in the area and rare, threatened and endangered species lists. After assembling this information, a walk-through habitat assessment of the study area will be conducted over a three to five day period with the ultimate goal of confirming that the appropriate assessment endpoint organisms were selected for evaluation in the Ecological Risk Assessment. Simple maps showing areas of trees, riparian vegetation, dominant flora, etc. will be prepared during this walk through. Animals and birds present in the study area will be determined by direct observation of the animals, recording indirect evidence such as tracks, droppings, etc. and listening to or recording bird calls.

After performance of the habitat assessment, types of vegetation to be sampled and used in the Ecological Risk Assessment will be selected and submitted to the Agency for acceptance. Since bullrushes are used as a food source by both ducks (seeds) and muskrats (plant), it is likely that this will be the plant species selected for sampling and chemical analysis. Compositing of various plant species at a sampling location may also be done in order to provide inputs to the Ecological Risk Assessment. Compositing of benthic organisms may also need to be done to obtain enough mass for chemical analysis.

11.2 Evaluation of Toxicity in Creek Segments B, C, D and E

As directed by USACE, sediment samples will be collected at three locations in Creek Segments B, C, D and E. Sediment bioassay, benthic organism and vegetation samples will also be collected at these locations, as directed by IEPA, in order to evaluate the risks to endpoint organisms resulting from the presence of site-related constituents (Figure 11).

If samples are collected at the high, average and low copper concentration location in each creek segment as directed by Weston, ecological sampling can not be done until May/June 2000 and total project duration will increase by 8 months (Section 16.0). In order to complete the EE/CA in 19 months, ecological samples need to be collected in the upper, middle and lower stretches of each creek segment during September/October 1999. Existing sediment quality data can be used to guide selection of these sampling locations.

Benthic community structure will be evaluated by collecting three sediment grab samples at each sampling station. A total of 36 benthic community structure evaluations will be done, one on each grab sample.

Number of Sediment Bioassays	12		
Number of Sediment Samples	12		
Analyses		VOCs	Method 8260B
		SVOCs	Method 8270C
		Metals	Method 6010B
		Mercury	Method 7471A
		Cyanide	Method 9010B
		PCBs	Method 680
		Pesticides	Method 8081A
		Herbicides	Method 8151A
		Dioxin	Method 8290

Number of Composite Benthic Organism Samples	4		
Number of Composite Vegetation Samples (Seeds/Stems)	12		
Number of Composite Vegetation Samples (Plant Roots)	12		
Total Number of Analyses	36		
Analyses		SVOCs	Method 8270C
		Metals	Method 6010B
		Mercury	Method 7471A
		Cyanide	Method 9010B
		PCBs	Method 680
		Pesticides	Method 8081A
		Herbicides	Method 8151A
		Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee. Sediment samples from the high, average and low copper concentration locations of each creek segment will be composited to provide sufficient benthic organism tissue mass for chemical analyses if the 26 month schedule is followed. Sediment samples from the upper, middle and lower portions of each creek segment will be composited to provide sufficient benthic organism tissue mass for chemical analysis if the 19 month schedule is followed.

11.3 Evaluation of Toxicity in Site M Sediments

As directed by Weston, sediment bioassay, benthic organism and vegetation samples will also be collected at one location in Site M in order to evaluate the risks to endpoint organisms resulting from the presence of site-related constituents. Samples will be collected at one of the four sediment sampling locations (Section 5.2 and Figure 4). Benthic community structure will be evaluated by collecting three sediment grab samples at the sampling station. A total of three benthic community structure evaluations will be done, one on each grab sample.

Number of Sediment Bioassays	1	
Number of Sediment Samples	1	
Number of Composite Benthic Organism Samples	1	
Number of Composite Vegetation Samples (Seeds/Stems)	1	
Number of Composite Vegetation Samples (Plant Roots)	1	
Total Number of Analyses	4	
Analyses	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

11.4 Evaluation of Toxicity in Creek Segment F

Sediment bioassay, benthic organism and vegetation samples will be collected at three locations in the stream portion of Creek Segment F between Route 157 and the Borrow Pit Lake (Figure 11) as directed by IEPA.

If samples are collected at the high, average and low copper concentration location in each creek segment as directed by Weston, ecological sampling can not be done until May/June 2000 and total project duration will increase by 8 months (Section 16.0). In order to complete the EE/CA in 19 months, ecological samples need to be collected in the upper, middle and lower stretches of each creek segment during September/October 1999. Existing sediment quality data can be used to guide selection of these sampling locations.

Benthic community structure will be evaluated by collecting three sediment grab samples at each sampling station. A total of nine benthic community structure evaluations will be done, one on each grab sample.

Number of Sediment Bioassays	3	
Number of Sediment Samples	3	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290
Number of Composite Benthic Organism Samples	1	
Number of Composite Vegetation Samples (Seeds/Stems)	3	
Number of Composite Vegetation Samples (Plant Roots)	3	
Total Number of Analyses	7	
Analyses	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A

Cyanide	Method 9010B
PCBs	Method 680
Pesticides	Method 8081A
Herbicides	Method 8151A
Dioxin	Method 8290

Sediment samples from the high, average and low copper concentration locations of each creek segment will be composited to provide sufficient benthic organism tissue mass for chemical analyses if the 26 month schedule is followed. Sediment samples from the upper, middle and lower portions of each creek segment will be composited to provide sufficient benthic organism tissue mass for chemical analysis if the 19 month schedule is followed.

Sediment bioassay, benthic organism, vegetation, crawfish and fish samples will be collected at three locations in the Creek Segment F Borrow Pit Lake to evaluate the risks to endpoint organisms resulting from the presence of site-related constituents (Figure 11). One sampling station will be located upstream of the discharge of Dead Creek, one sampling station will be located near the discharge of Dead Creek and one sampling station will be located downstream of the discharge of Dead Creek. Benthic community structure will be evaluated at each sampling station, a total of three benthic community structure evaluations. Biological sampling stations will be collected with sediment sampling stations (Section 8.4). Large mouth bass will be sampled in the Borrow Pit Lake in order to provide fillet information for the human health risk assessment (recreational fishing exposure pathway). If large mouth bass are nolt present or present in insufficient quantities, other game fish such as crappie will be collected in order to obtain the fillet samples needed for the Human Health Risk Assessment. Each composite fish and crawfish sample will include at least five individual organisms.

Number of Sediment Bioassays	3
Number of Sediment Samples	3
Number of Benthic Organism Samples	3
Number of Composite Vegetation Samples (Seeds/Stems)	3
Number of Composite Vegetation Samples (Plant Roots)	3
Number of Composite Crawfish Samples	3
Number of Composite Small Forager Fish Samples	3 (Whole Body)
Number of Composite Medium Bottom Feeder Fish Samples	3 (Whole Body)

Number of Composite Large Predator Fish Samples	3 (Whole Body)	
Number of Composite Game Fish Samples	3 (Fillet)	
Total Number of Analyses	27	
Analyses	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

Each composite fish tissue sample will be analyzed for lipids. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

11.5 Evaluation of Toxicity in the Reference Area

Surface water, sediment, sediment bioassay, benthic organism, vegetation, crawfish and fish tissue samples will be collected in two reference areas in the Dead Creek watershed, or in a watershed that includes industrial, commercial, residential and farming land uses comparable to that in the Dead Creek watershed, in order to provide a basis for comparison with the Dead Creek ecological assessment samples. One reference area will represent flowing water and the other reference area will represent still water. The reference areas will be either Old Prairie du Pont Creek upstream of its confluence with Dead Creek or Harding Ditch upstream of its confluence with Old Prairie du Pont Creek. A qualified wildlife biologist will conduct a qualitative evaluation of these potential reference area locations and identify the reference areas with habitats most similar to those of Dead Creek. Results of this reference area evaluation and selection effort will be summarized in a letter report and submitted to the Agency for acceptance. Ecological sampling at all locations will be performed after Agency acceptance of the proposed reference area.

Surface water, sediment, sediment bioassay, benthic organism, vegetation, crawfish and fish tissue samples will be collected at two locations in each reference area. Benthic community structure will be evaluated by collecting three sediment grab samples at each sampling station. A total of 12 benthic community structure evaluations will be done, one on each grab sample. Each composite fish and crawfish samples will include at least five individual organisms.

Number of Sediment Bioassays	4	
Number of Surface Water Samples	4	
Number of Sediment Samples	4	
Total Number of Analyses	8	
Analyses	VOCs	Method 8260B
	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290
Number of Benthic Organism Samples	4	
Number of Composite Vegetation Samples (Seeds/Stems)	4	
Number of Composite Vegetation Samples (Plant Roots)	4	
Number of Composite Crawfish Samples	4	
Number of Composite Small Forager Fish Samples	4 (Whole Body)	
Number of Composite Medium Bottom Feeder Fish Samples	4 (Whole Body)	
Number of Composite Large Predator Fish Samples	4 (Whole Body)	
Number of Composite Game Fish Samples	4 (Fillet)	
Total Number of Analyses	32	
Analyses	SVOCs	Method 8270C
	Metals	Method 6010B
	Mercury	Method 7471A
	Cyanide	Method 9010B
	PCBs	Method 680
	Pesticides	Method 8081A
	Herbicides	Method 8151A
	Dioxin	Method 8290

Each fish tissue sample will be analyzed for lipids. All sampling locations will be selected in the field with the concurrence of the USEPA or its designee.

11.6 Assessment of Endpoint Organisms

Information from Creek Segments B, C, D, E and F will be used to perform an Ecological Risk Assessment (Volume 1C of the SSP). The benthic macroinvertebrate community, a warm water fish (largemouth bass), two fish-eating birds (great blue heron and the bald eagle), a vegetation and benthic macroinvertebrate-eating bird (mallard duck), a fish-eating mammal (river otter) and a vegetation-eating mammal (muskrat) will be used as assessment endpoints for the Ecological Risk Assessment.

The river otter was selected as the fish-eating mammal endpoint organism because this animal represents a top piscivorous carnivore and the worst case situation will respect to using fish and other aquatic life as a food source. While mink are well studied, the river otter is believed to "... have similar sensitivity to organochlorines as mink." (Wren, C.D., Cause-Effect Linkages Between Chemicals and Populations of Mink (Mustela vison) and Otter (Lutra canadensis) in the Great Lakes Basin, J. of Tox. And Envir. Health, 33:549-585, 1991). Since the otter has a greater reliance on fish and other aquatic organisms as a food source, and has a sensitivity to organochlorines similar to the mink, it is a better choice for the evaluation of ecological risks in the habitat found at Dead Creek.

11.7 Exposure Pathways

See Volume 1C Ecological Risk Assessment Work Plan.

11.8 Toxicity Testing or Trapping

See Volume 3 Ecological Risk Assessment QAPP and FSP.

12.0 Pilot Treatability Test Sampling Plan

Treatability pilot tests will be conducted on wastes and sediments in order to identify any characteristics of these materials that would prevent their treatment using off-site incineration or on-site thermal desorption.

Stabilization treatability pilot tests will be conducted to determine the appropriate mix of stabilizing agents needed to reduce metals and organics leaching.

Leachate treatability pilot testing will be done to determine the appropriate combination of physical/chemical and/or biological treatment processes that are needed to achieve pretreatment requirements for discharge to the American Bottoms POTW. Leachate from Sites G and I is considered representative of leachate found in the fill areas.

12.1 Off-Site Waste Incineration Pilot Treatability Tests

One composite organic waste sample will be made from the waste samples collected from the waste characterization borings installed at fill each area (Sites G, H, I, L and N). Individual aliquots of this sample will be sent to four RCRA/TSCA-permitted, fixed-facility incinerators for waste profiling, material handling characterization and evaluation of the feasibility of disposing of the waste material by off-site incineration. Current plans call for sending two aliquots to the SafetyKleen facilities at Deer Park, Texas and Coffeyville, Kansas or to a testing location designated by SafetyKleen. SafetyKleen in Coffeyville, Kansas is the only incineration facility permitted to accept dioxin-containing materials from RCRA-listed processes. Two aliquots will be sent to the Waste Management incinerators at Sauget, Illinois and Port Arthur, Texas or to a testing facility designated by Waste Management. These four facilities are the fixed-facility hazardous waste incinerators closest to Sauget Area 1.

12.2 On-Site Waste Thermal Desorption Pilot Treatability Tests

One composite organic waste sample will be made from the waste samples collected from the waste characterization borings installed at each fill area (Sites G, H, I, L and N). Aliquots of this sample will be sent to three RCRA/TSCA-permitted thermal desorption contractors for waste profiling, material handling characterization and evaluation of the feasibility of treating the waste material by thermal desorption. Consolidations and bankruptcies in the environmental services market make it unclear who has mobile thermal desorption equipment permitted to handle PCBs and dioxin. In the past, Canonie, McLaren/Hart, SRS and Weston had thermal desorbers designed to operate in a low-oxygen or oxygen-free mode. Research will be done to determine who is still in the pyrolitic thermal desorption business and who has a nation-wide permit to handle PCB and dioxin-containing materials. Contractors will be identified to the Agency 30 days before the pilot test samples are shipped.

12.3 On-Site Sediment Thermal Desorption Pilot Treatability Tests

Sediment samples will be collected every 200 ft. in Creek Segment B and at 10 locations in Site M to create one composite sediment sample to be used in the sediment on-site thermal desorption pilot treatability testing. Aliquots of this sample will be sent to three RCRA/TSCA-permitted thermal desorption contractors for waste profiling, material handling characterization and evaluation of the feasibility of treating the waste material by thermal desorption. Consolidations and bankruptcies in the environmental services market make it unclear who has mobile thermal desorption equipment permitted to handle PCBs and dioxin. In the past, Canonie, McLaren/Hart, SRS and Weston had thermal desorbers designed to operate in a low-oxygen or oxygen-free mode. Research will be done to determine who is still in the pyrolitic thermal desorption business and who has a nation-wide permit to handle PCB and dioxin-containing materials. Contractors will be identified to the Agency 30 days before the pilot test samples are shipped

12.4 Sediment Stabilization Pilot Treatability Tests

One sediment sample will be collected at the sampling station with the highest detected organic concentrations and one sediment sample will be collected at the sampling station with the highest detected metal concentrations. Stabilization mix testing treatability pilot tests will be conducted on the two samples to determine stabilant mixes that will: 1) solidify sediments to pass the paint filter test, 2) solidify sediments to a bearing capacity of 2000 pounds per square foot and/or 3) reduce metals or organics leaching. Stabilization mix testing will be done by Kiber Environmental Services, Atlanta, Georgia.

12.5 Leachate Treatment Pilot Treatability Tests

Leachate treatability pilot tests will be conducted on samples collected from Sites G and I to determine if pretreatment limits can be achieved prior to discharge to the American Bottoms POTW. One leachate sample will be collected from Site I and one leachate sample will be collected from Site G using the 2-inch diameter well installed at each of these fill areas as part of the Waste Characterization Sampling Plan. As required by USACE, these wells will be stressed so that a representative leachate sample can be collected. Pumping will be limited by constraints imposed by leachate storage and disposal requirements. Pilot treatability testing will be conducted by the Advent Group, Brentwood, Tennessee.

13.0 Support Sampling Plan Data Report

The Support Sampling Plan Data Report, in table-form with corresponding figures, will be provided to USEPA and IEPA. This report will summarize the sampling results from the EE/CA and RI/FS Support Sampling. The results of all pilot treatability tests will be included in the Data Report. If requested by USEPA, copies of all raw data will be provided.

All data resulting from chemical analysis of samples collected as part of this SSP will be submitted to the Agency in an Excell-compatible electronic spread sheet that includes the following information:

- latitude in decimal degrees
- longitude in decimal degrees
- sample identification number
- sample matrix (soil, groundwater, surface water, sediment, air)
- sample depth
- time and date of sample collection
- time and date of sample analysis
- chemical parameters
- analytical results
- analysis method
- detection limit
- measurement units (ppm, ppb, mg/kg, etc.)
- analytical result qualifiers (non-detect, etc.)

14.0 EE/CA and RI/FS Reports

The EE/CA and RI/FS Reports will be prepared as required by the AOC and by applicable guidance. Guidance to be used in preparing the EE/CA report is "Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA". Guidance to be used in preparing the RI/FS report is "Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA". Work plans for the EE/CA Report and the RI/FS Report are included in Volume 1D and 1E of the Support Sampling Plan.

15.0 Project Team Organization

Solutia has assembled a skilled and experienced project team to conduct the Support Sampling Plan and prepare the Support Sampling Plan Data Report, the Human Health Risk Assessment (HHRA), the Ecological Risk Assessment (ERA) and the EE/CA and RI/FS Reports. This team approach brings a wide diversity of experience and knowledge to the project. Solutia will lead and manage the project team to implement the studies called for in the AOC SOW.

Principal members of the Support Sampling Team (SST) and their roles are described below.

Mike Light and Bruce Yare of Solutia are the leadership team for this project. Mr. Light will be the Project Coordinator and will be responsible for overall project quality and schedule. He will be the primary contact for the project.

Mr. Yare will be responsible to technical project quality and will be the Project Manager for the data interpretation portions of the project such as the Support Sampling Plan Data Report, HHRA, ERA and EE/CA and RI/FS Reports. Mr. Yare will also be responsible for insuring the efficient transfer of soil, groundwater, surface water, sediment and air sampling and analysis information from the data collection contractor, O'Brien & Gere, to the data interpretation contractor, Roux Associates. Regular project meetings will be held with Dean Palmer of O'Brien & Gere and John Loper of Roux Associates during the data collection and data interpretation activities in order to insure smooth integration of the two functions and facilitate preparation of the EE/CA Report and RI/FS Report.

Kimberly Perry, also of Solutia, will be the Project Manager for field data collection activities.

Dean Palmer of O'Brien & Gere is responsible for the team collecting the soil, surface water, sediment and air samples and preparing the Support Sampling Plan Data Report. Lisa Bradley of ENSR is responsible for leading the team that will prepare the Human Health Risk Assessment. Charlie Menzie and Jerry Cura of Menzie•Cura & Associates are responsible for the team collecting the ecological samples and preparing the Ecological Risk Assessment. Betsy Beauchamp of Savannah Laboratories is responsible for laboratory analyses. Kathy Blaine of Environmental Standards is responsible for data validation. John Loper of Roux Associates is responsible for leading the team that will prepare the EE/CA and RI/FS Reports.

Mr. David E. Haverdink of O'Brien & Gere will be the Site Safety and Health Coordinator for the soil, groundwater, surface water, sediment and air sample collecting activities. Menzie•Cura has not yet identified its Site Safety and Health Coordinator for ecological sample collection. This person will be identified to the Agency within 30 days of submittal of this SSP.

Ms. Karen Stone of O'Brien & Gere will be the QA Officer for the soil, groundwater, surface water, sediment and air sample collection and analysis. Dr. Nancy C. Rothman will be the QA Officer for organic sample collection and analysis and Ms. Susan D. Chapnick will be the QA Officer for inorganic sample collection and analysis for samples collected as part of the ecological sampling program included in this SSP.

Internal peer review of the Human Health Risk Assessment and Ecological Risk Assessment will be provided by Solutia employees Drs. James Sherman and Gerald Coyle, respectively. External peer review will be provided by Jon Dikinis of Montgomery Watson and Rich Bartelt of Arcadis Geraghty & Miller.

Technical expertise on natural attenuation will be provided by Dr. Charles Newell of Groundwater Services.

Solutia understands that the USEPA is responsible for the Community Relations Plan (CRP) required by the NCP and that the Agency will take the lead in community relations and public participation activities. Solutia intends to support the Agency's community relations and public participation efforts and will participate as appropriate. Solutia will also facilitate meaningful public participation through the documents that it produces. Solutia anticipates that whatever CRP the USEPA provides will be NCP compliant and thus meet any obligations Solutia may have relative to subsequent cost recovery actions that Solutia may pursue.

16.0 Schedule

16.1 19 Month Schedule

The June 25, 1999 SSP contained a 19 month project schedule (Section 16.0) that consisted of one month startup/mobilization plus 18 months of project work. An 19 month project duration is dependent on collecting ecological samples at depositional areas in the upper, middle and lower stretches of each creek segment during September and October 1999.

Major project elements of the 19 month schedule, and their duration, are given below:

Project Start Up/ Mobilization	1 Month
Waste, Groundwater, Soil, Sediment, Surface Water, Air and Ecological Sample Collection, Analysis and Data Validation	11 Months
Data Report, Human Health Risk Assessment and Ecological Risk Assessment	4 Months
Engineering Evaluation/Cost Assessment Report	2 Months
Remedial Investigation/Feasibility Study	1 Month
Total Project Duration	19 Months

A 19 month bar chart schedule is included at the end of this section. Note that the RI/FS Report will be prepared concurrently with the EE/CA Report. The AOC allows 60 days for preparation of the EE/CA Report and 90 days for preparation of the RI/FS Report.

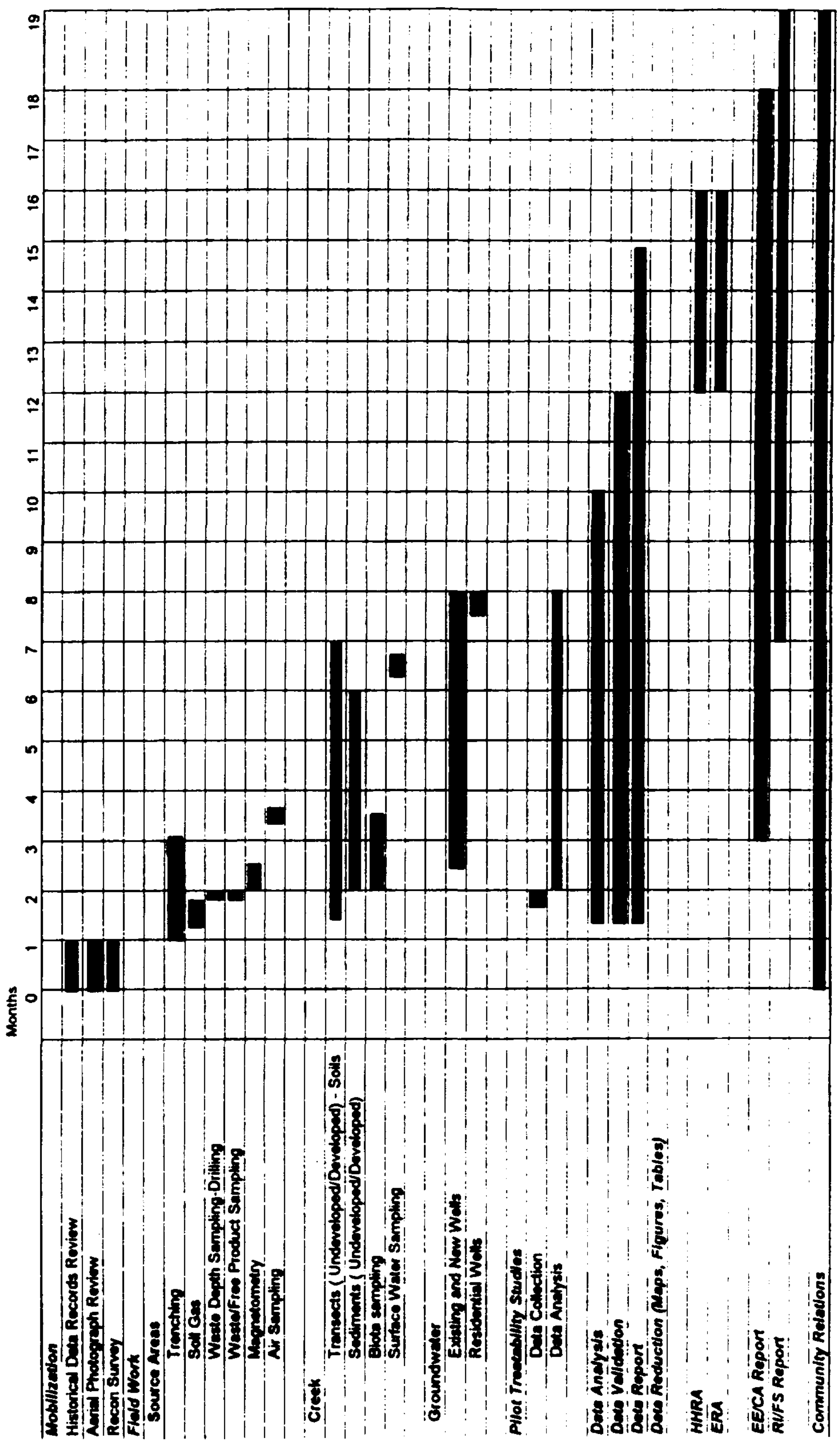
16.2 26 Month Schedule

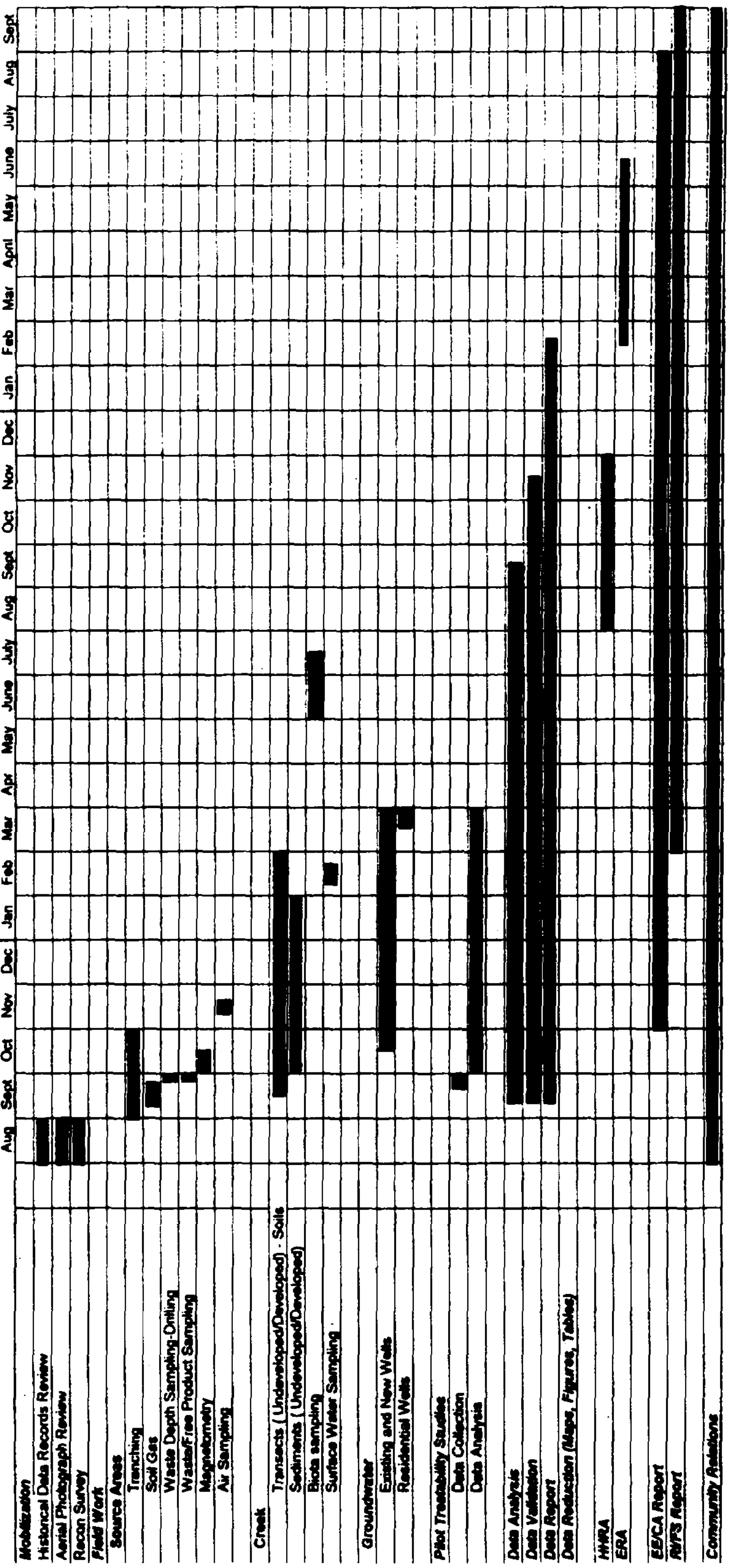
If ecological samples are collected at the high, average and low copper concentration locations in each creek segment, as directed by Weston on July 27, 1999, ecological sample collection can not be done until: 1) sediment samples are collected, analyzed, validated and compiled, 2) discussions are held with the Agency to determine the appropriate concentration-based sampling locations and 3) aquatic vegetation is fully emergent. Sediment sampling will start in October 1999 and sample analysis, validation and compilation will finish by the end of January 2000 if the Agency approves the SSP during the week of August 16, 1999. The next ecological sampling window after the January 2000 completion of sediment sampling, analysis, validation and compilation is May/June 2000 when aquatic vegetation will be fully emergent. Collecting ecological samples in May/June 2000 will extend project duration by 8 months and result in a total project schedule of 26 months.

Major project elements of the 26 month schedule, and their duration, are given below:

Project Start Up/ Mobilization	1 Month
Waste, Groundwater, Soil, Sediment, Surface Water, Air and Ecological Sample Collection, Analysis and Data Validation; Data Report and Human Health Risk Assessment	18 Months
Ecological Risk Assessment	4 Months
Engineering Evaluation/Cost Assessment Report	2 Months
Remedial Investigation/Feasibility Study	1 Month
Total Project Duration	26 Months

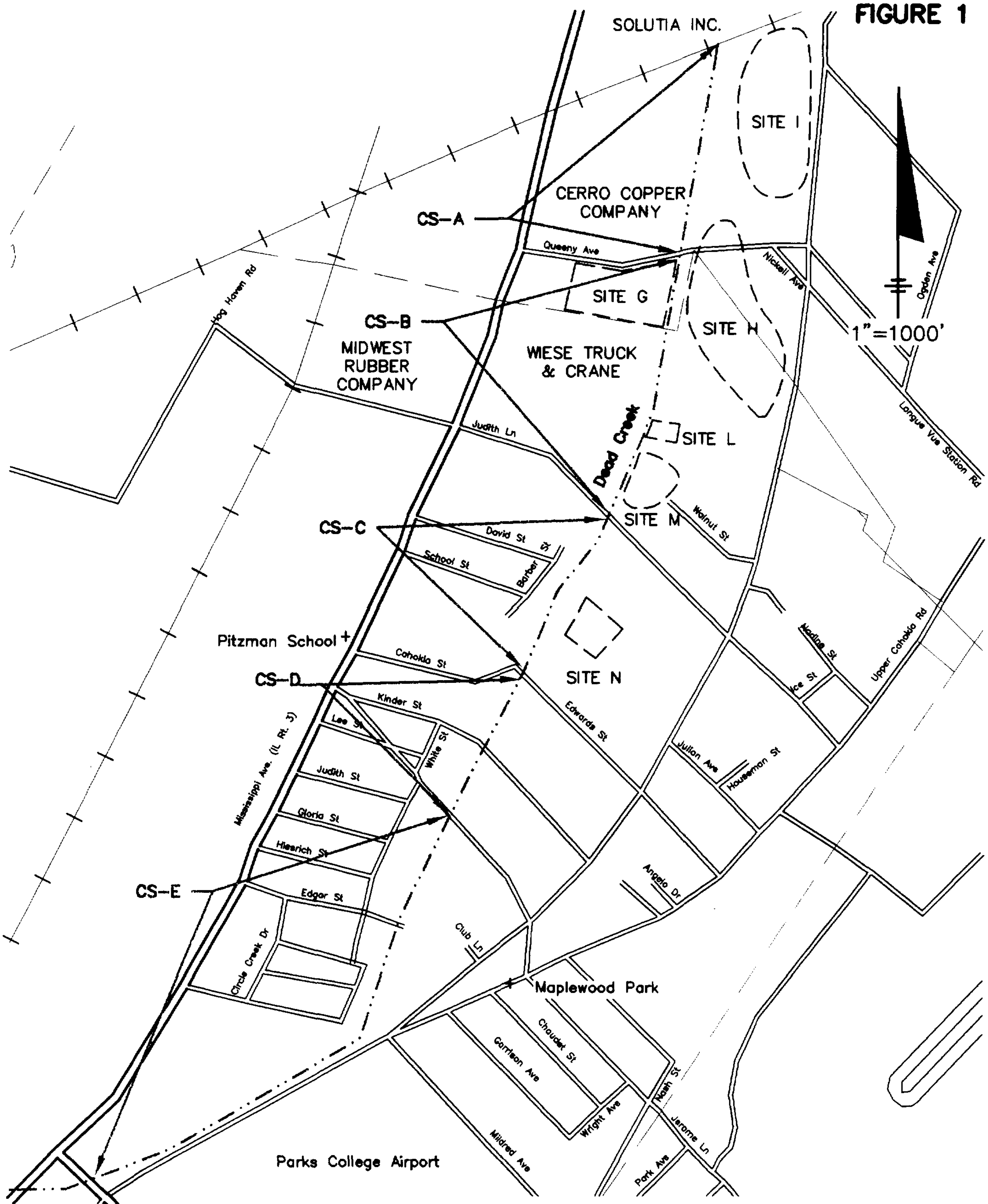
A 26 month bar chart schedule is included at the end of this section.


Months
0
1
2
3
4
5
6
7
8
9
10
11
12
13
14
15
16
17
18
19
Mobilization
Historical Data Records Review
Aerial Photograph Review
Recon Survey
Field Work
Source Areas
Trenching
Soil Gas
Waste Depth Sampling-Drilling
Waste/Free Product Sampling
Magnetometry
Air Sampling
Creek
Transects (Undeveloped/Developed/Developed) - Soils
Sediments (Undeveloped/Developed/Developed)
Biota sampling
Surface Water Sampling
Groundwater
Existing and New Wells
Residential Wells
Pilot Treatability Studies
Data Collection
Data Analysis
Data Analysis
Data Validation
Data Report
Data Reduction (Maps, Figures, Tables)
HHRA
ERA
EE/CA Report
RI/FS Report
Community Relations


1999
Aug
Sept
Oct
Nov
Dec
2000
Jan
Feb
Mar
Apr
May
June
July
Aug
Sept
Oct
Nov
Dec
2001
Jan
Feb
Mar
April
May
June
July
Aug
Sept
Mobilization
Historical Data Records Review
Aerial Photograph Review
Recon Survey
Field Work
Source Areas
Trenching
Soil Gas
Waste Depth Sampling-Drilling
Waste/Free Product Sampling
Magnetometry
Air Sampling
Creek
Transects (Undeveloped/Developed) - Soils
Sediments (Undeveloped/Developed)
Biota sampling
Surface Water Sampling
Groundwater
Existing and New Wells
Residential Wells
Pilot Treatability Studies
Data Collection
Data Analysis
Data Analysis
Data Validation
Data Report
Data Reduction (Maps, Figures, Tables)
HHRA
ERA
EE/CA Report
RI/FS Report
Community Relations

Figures

FIGURE 1



SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET & CAHOKIA, IL

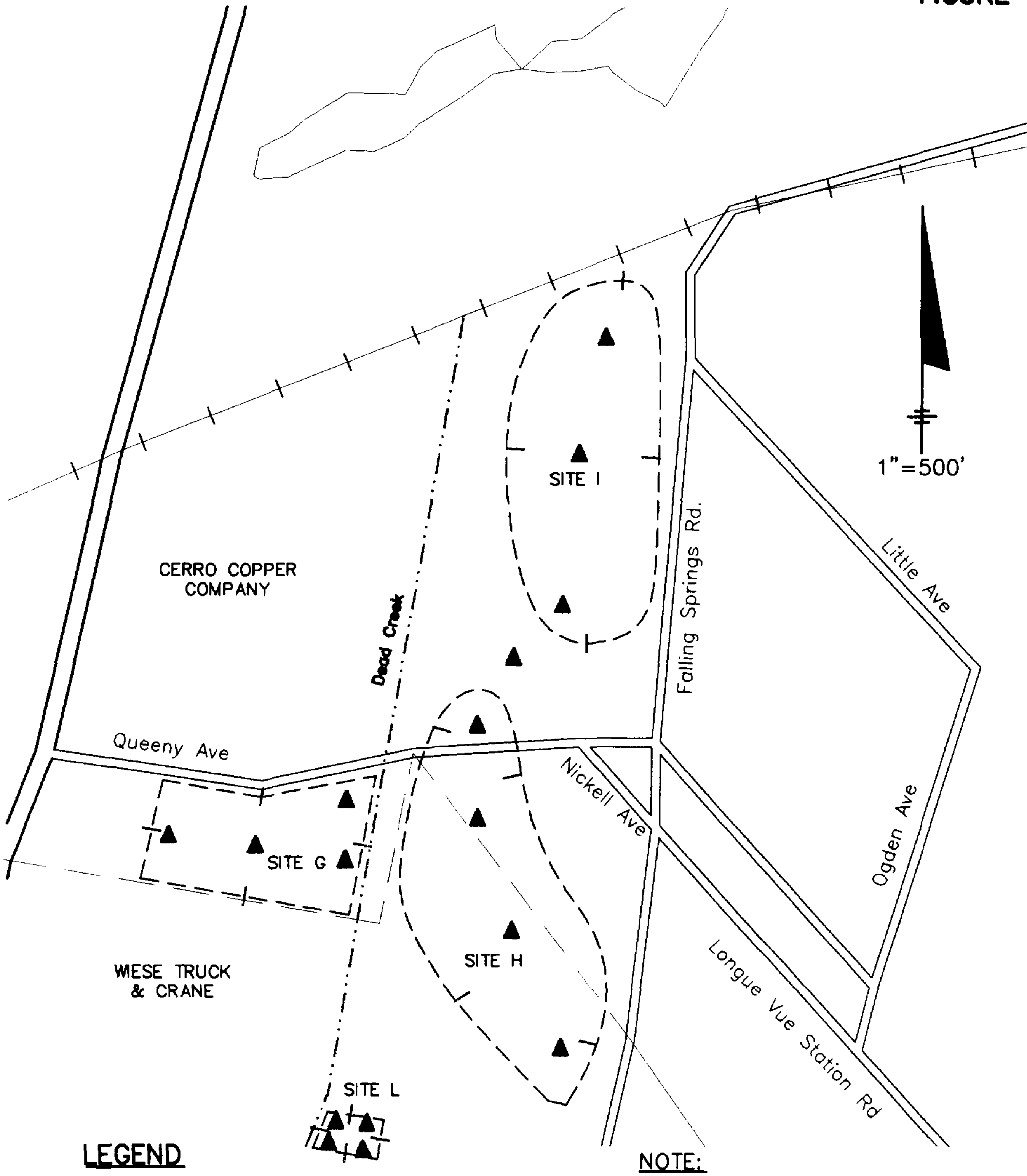
FILL AREA & CREEK SECTOR LOCATION MAP

23548.010.05
3/29/99

ENGINEERS INC.

PLOT DATE: ,1/99

FIGURE 2



LEGEND

— BOUNDARY CONFIRMATION TRENCH

▲ WASTE CHARACTERIZATION BORING

NOTE:

1. TRENCH AND BORING LOCATIONS WILL BE FINALIZED AFTER COMPLETING AIR PHOTO ANALYSIS OF THE FILL AREAS.

SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET & CAHOKIA, IL

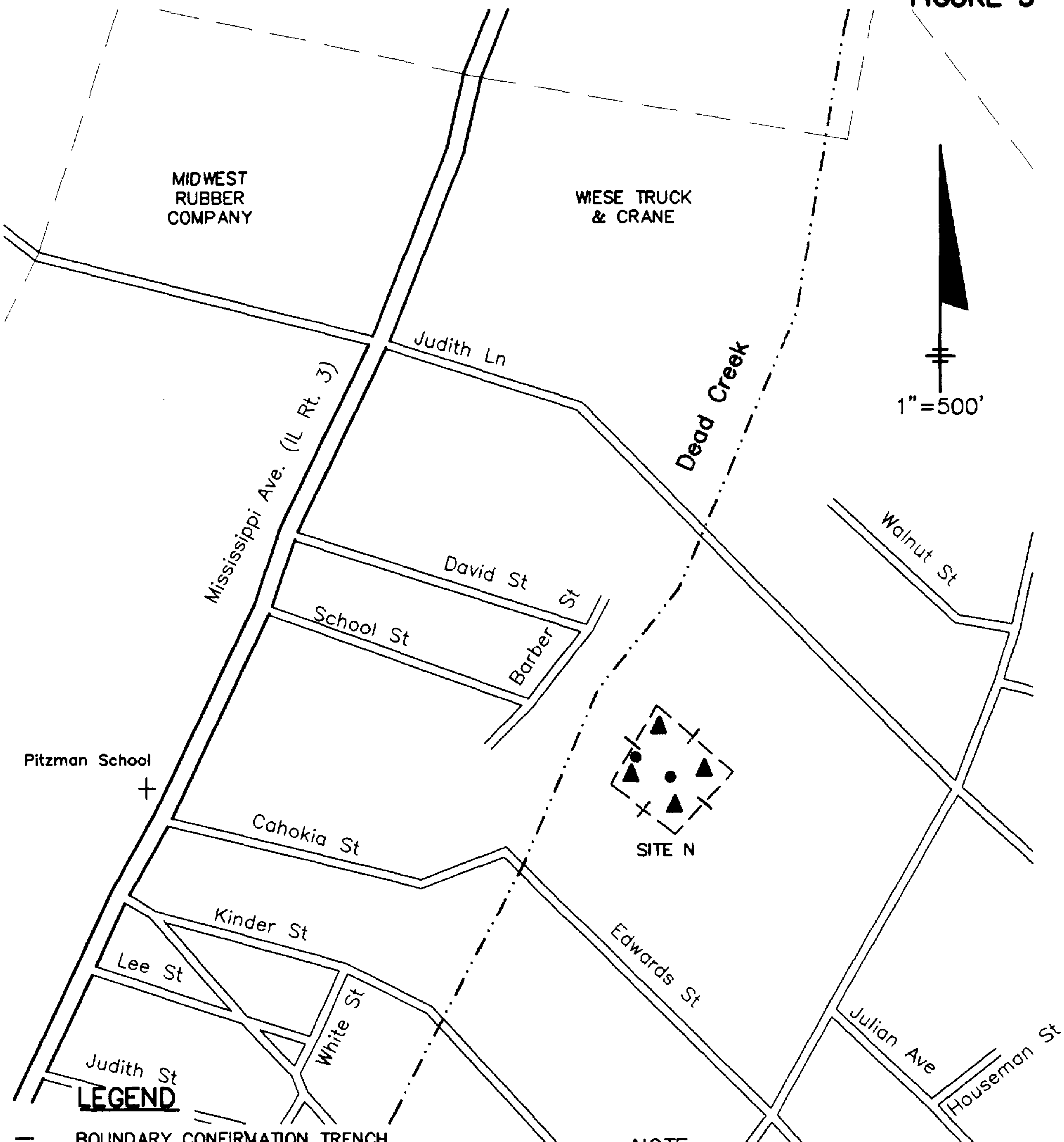
PRELIMINARY BOUNDARY CONFIRMATION TRENCH & WASTE CHARACTERIZATION BORING LOCATIONS AT SITES G, H, I & L

23548.010.06
3/29/99

ENGINEERS INC.

PLOT DATE: ·,·/99

FIGURE 3



LEGEND

— BOUNDARY CONFIRMATION TRENCH

▲ WASTE CHARACTERIZATION BORING

● SUBSURFACE SOIL SAMPLE LOCATION

NOTE:

1. TRENCH AND BORING LOCATIONS WILL BE FINALIZED AFTER COMPLETING AIR PHOTO ANALYSIS OF THE FILL AREAS.

SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

PRELIMINARY BOUNDARY CONFIRMATION TRENCH & WASTE CHARACTERIZATION BORING LOCATIONS AT SITE N

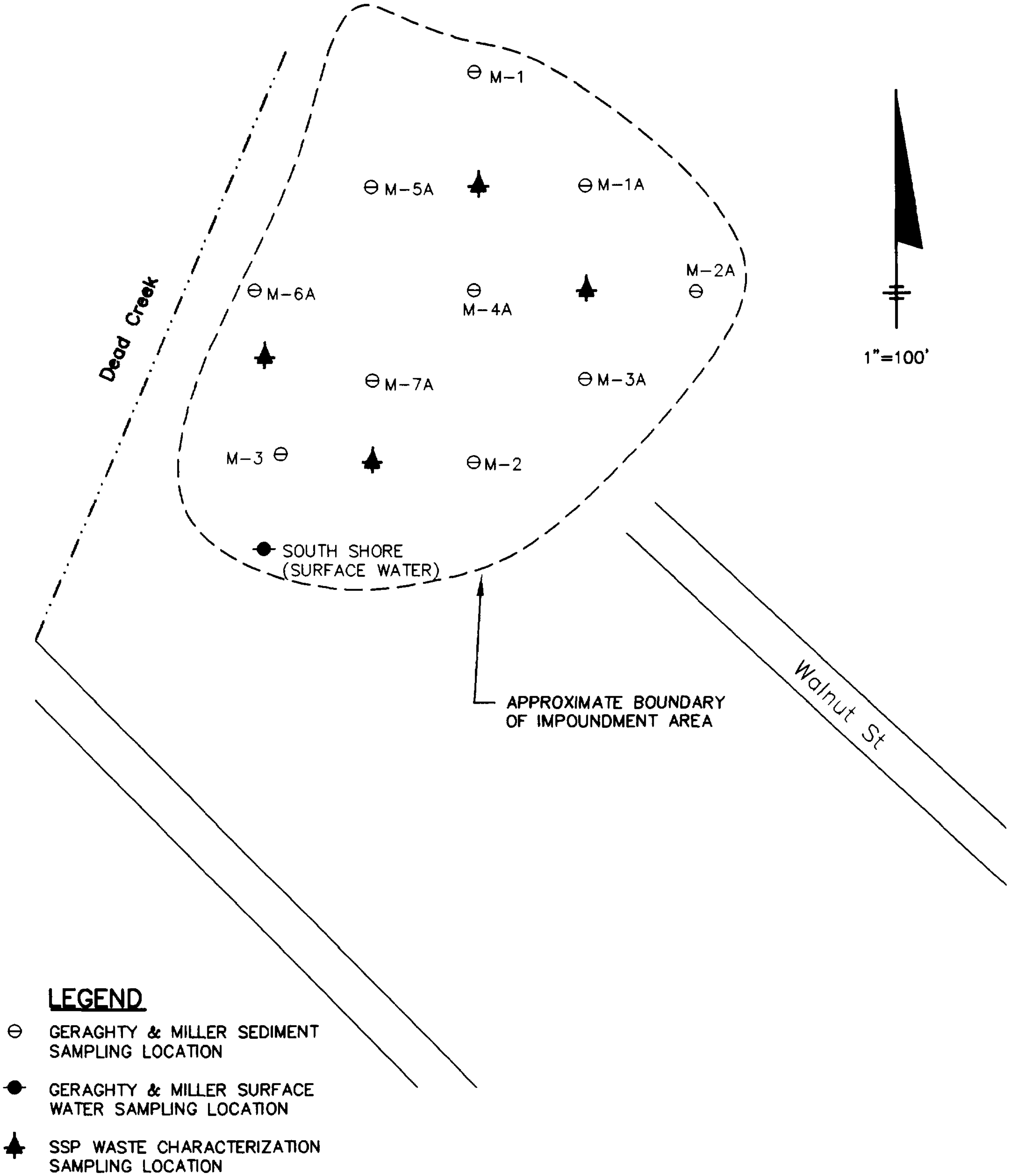
23548.010.07
3/30/99

ENGINEERS INC.

DWG PATH: I:\PROJECTS\10040\23548\DW 07.DWG 1=500

PLOT DATE: 4/1/

FIGURE 4



SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

PRELIMINARY WASTE CHARACTERIZATION
SAMPLING LOCATIONS AT SITE M

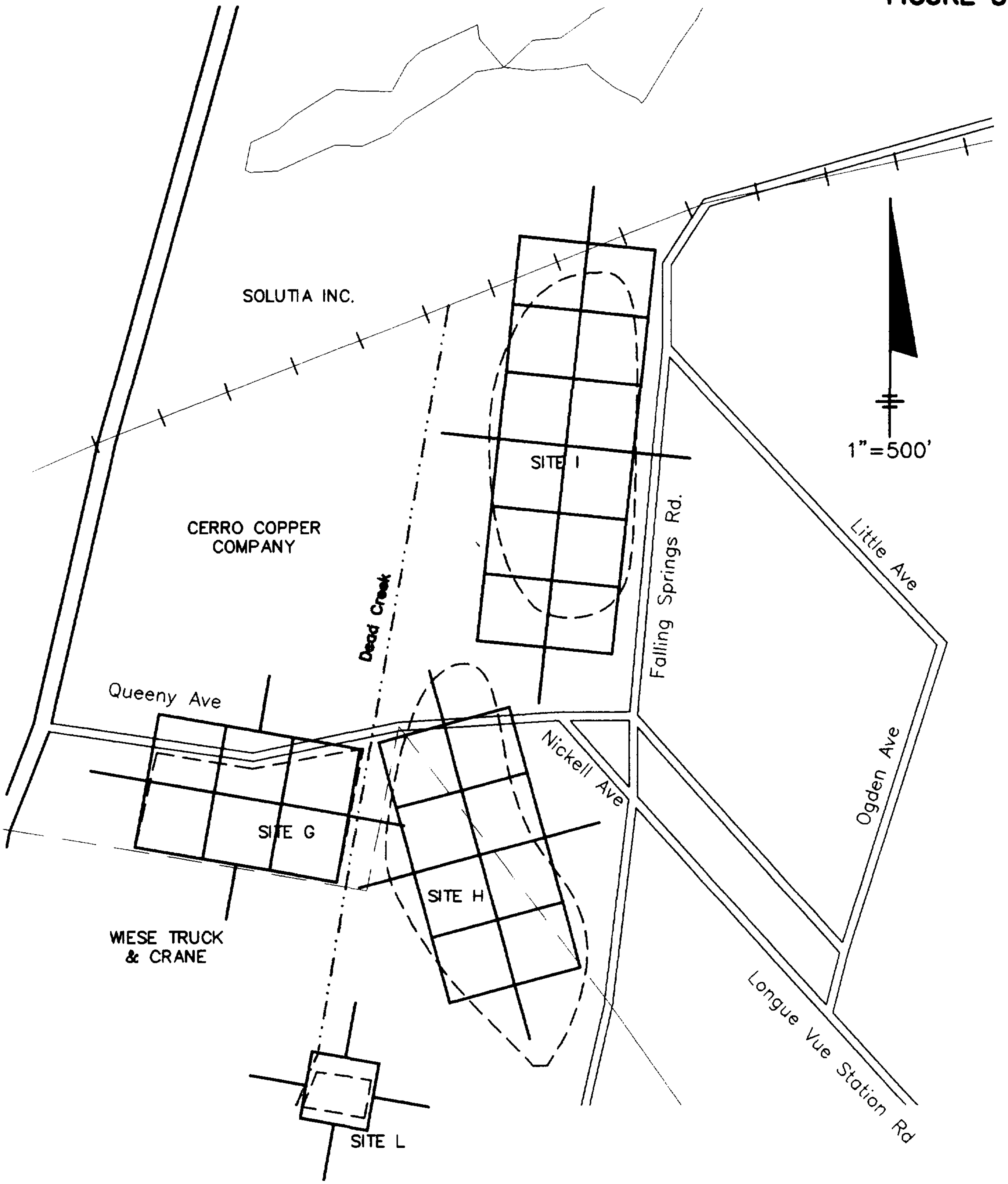
23548.010.08
3/30/99

ENGINEERS INC.

DWG PATH: I:\PROJECTS\10040\23548\ 08.DWG 1=200

PLOT DATE: 4/

FIGURE 5



SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET & CAHOKIA, IL

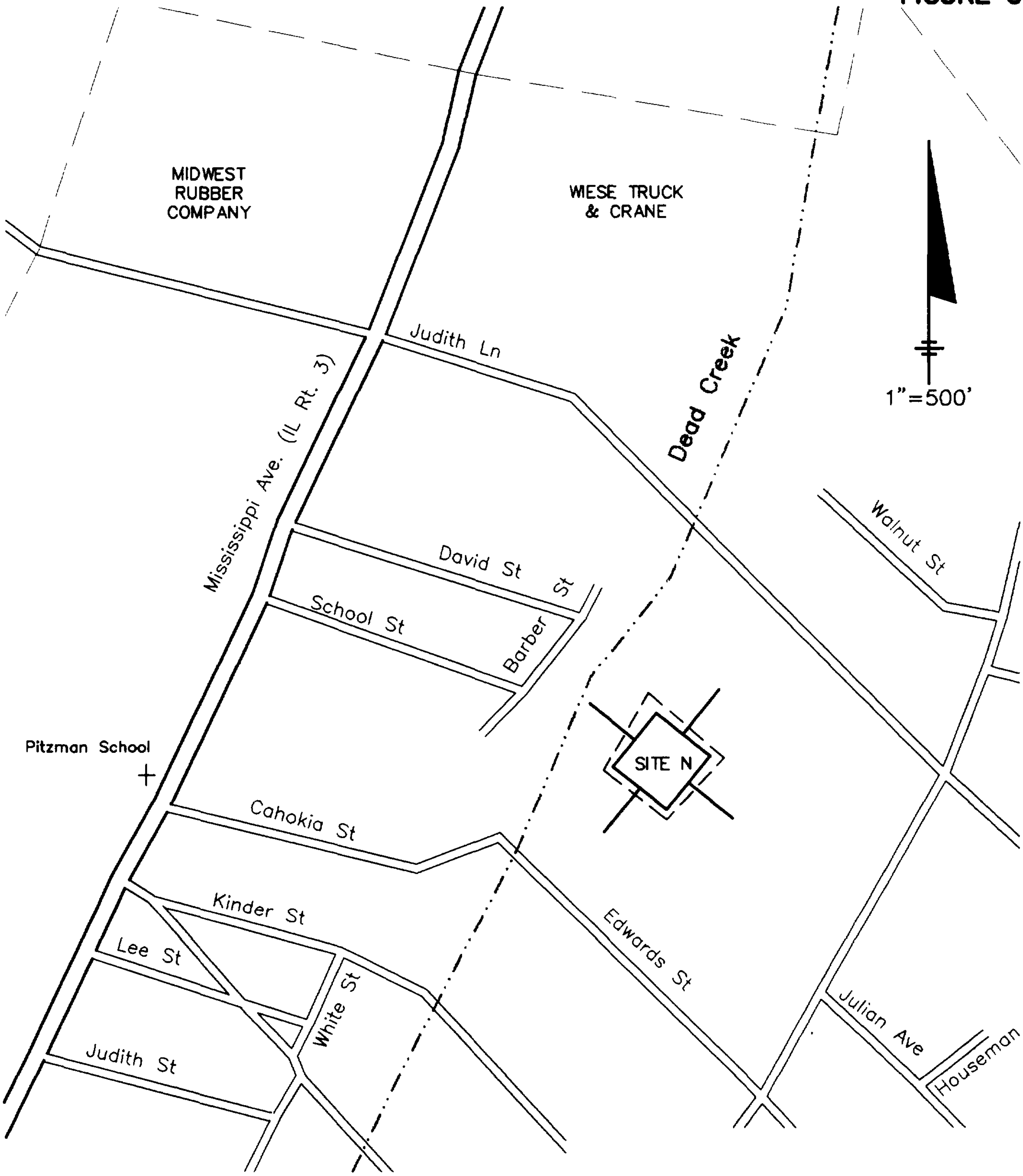
SOIL GAS SURVEY SAMPLING GRID AT SITES G, H, I & L

23548.010.09
3/30/99

O'BRIEN & GERE ENGINEERS INC.

PLOT DATE: 3/

FIGURE 6



SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

SOIL GAS SURVEY SAMPLING GRID
AT SITE N

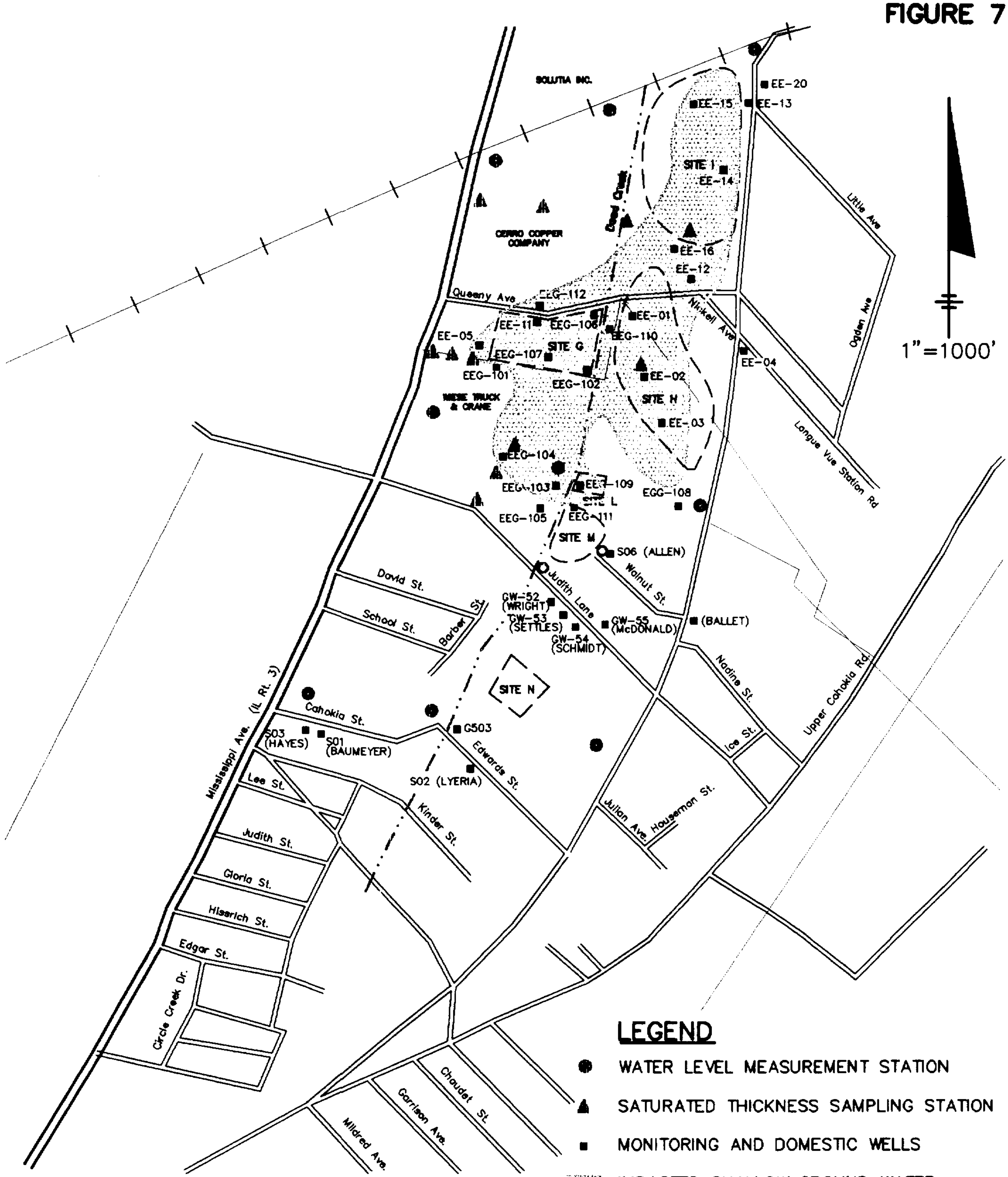
23548.010.10
3/30/99

ENGINEERS INC.

DWG PATH: I:\PROJECTS\10040\23548\DWG\10.DWG 1=500

PLOT DATE: 3/30/99

FIGURE 7



LEGEND

- WATER LEVEL MEASUREMENT STATION
- SATURATED THICKNESS SAMPLING STATION
- MONITORING AND DOMESTIC WELLS
- IMPACTED SHALLOW GROUND WATER
- SHALLOW GROUND WATER SAMPLING STATION

SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET & CAHOKIA, IL

GROUND WATER SAMPLING LOCATIONS

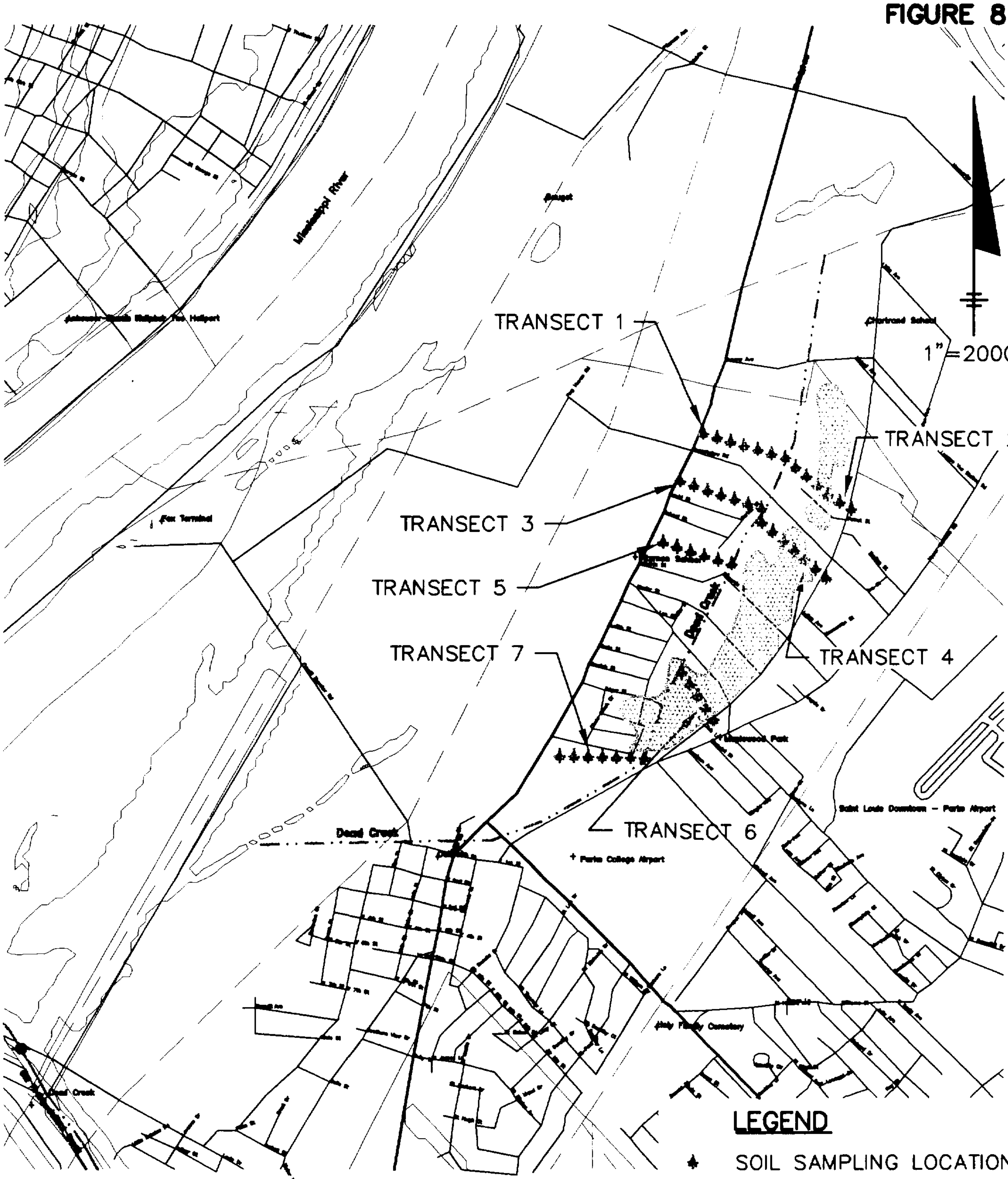
23548.010.11
3/30/99

O'BRIEN & GERE ENGINEERS INC.

PLOT DATE: 3/3...

DWG PATH: I:\10040\23548\DWG MG 1=2000

FIGURE 8



LEGEND
SOIL SAMPLING LOCATION
FEMA FLOOD ZONE

SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

SOIL SAMPLING LOCATIONS

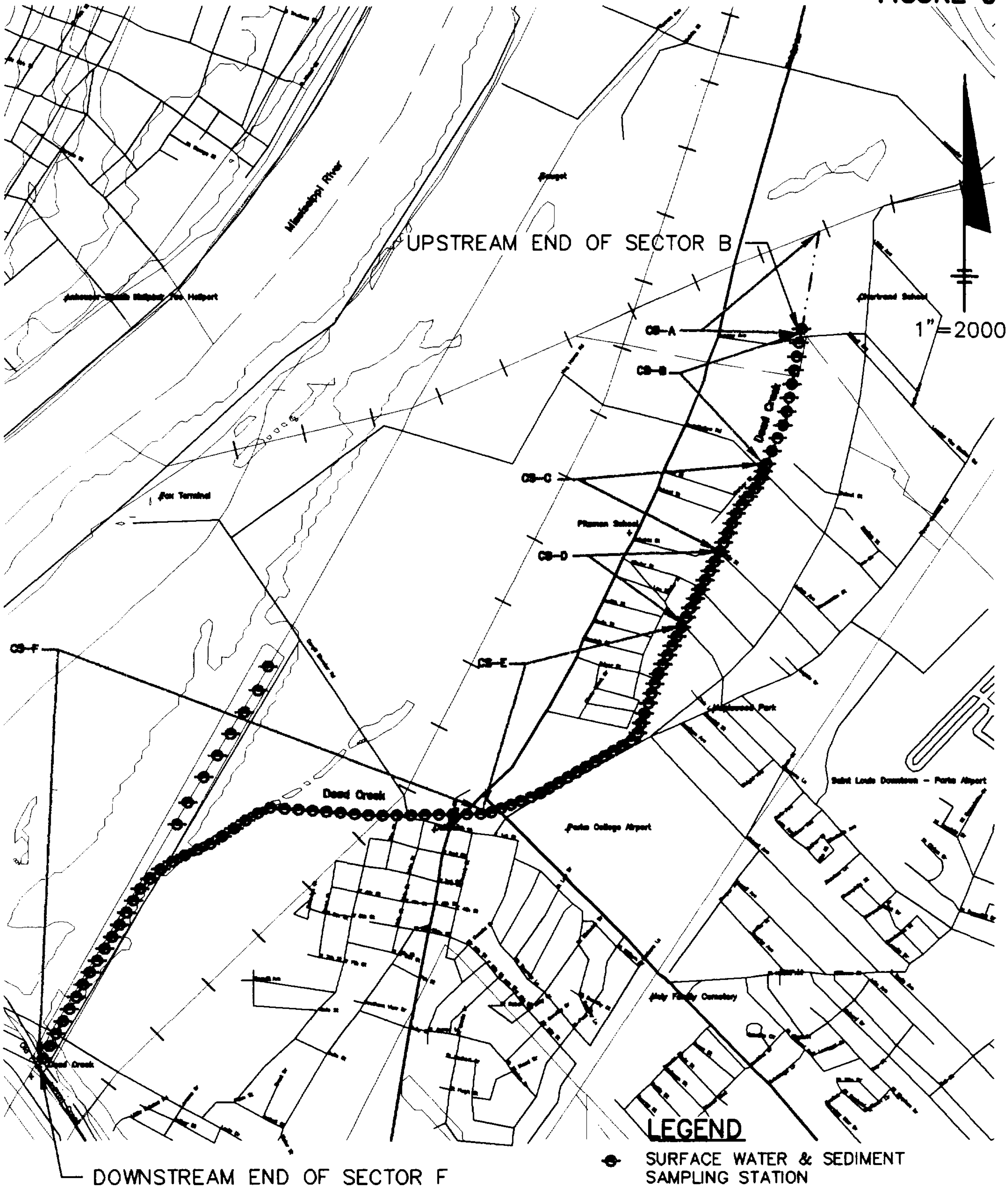
23548.010.04
3/29/99

PLOT DATE: 4/2/9

O'BRIEN & GERE ENGINEERS INC.

DWG PATH: I:\10040\23548\03.DWG 1=2000

FIGURE 9



SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

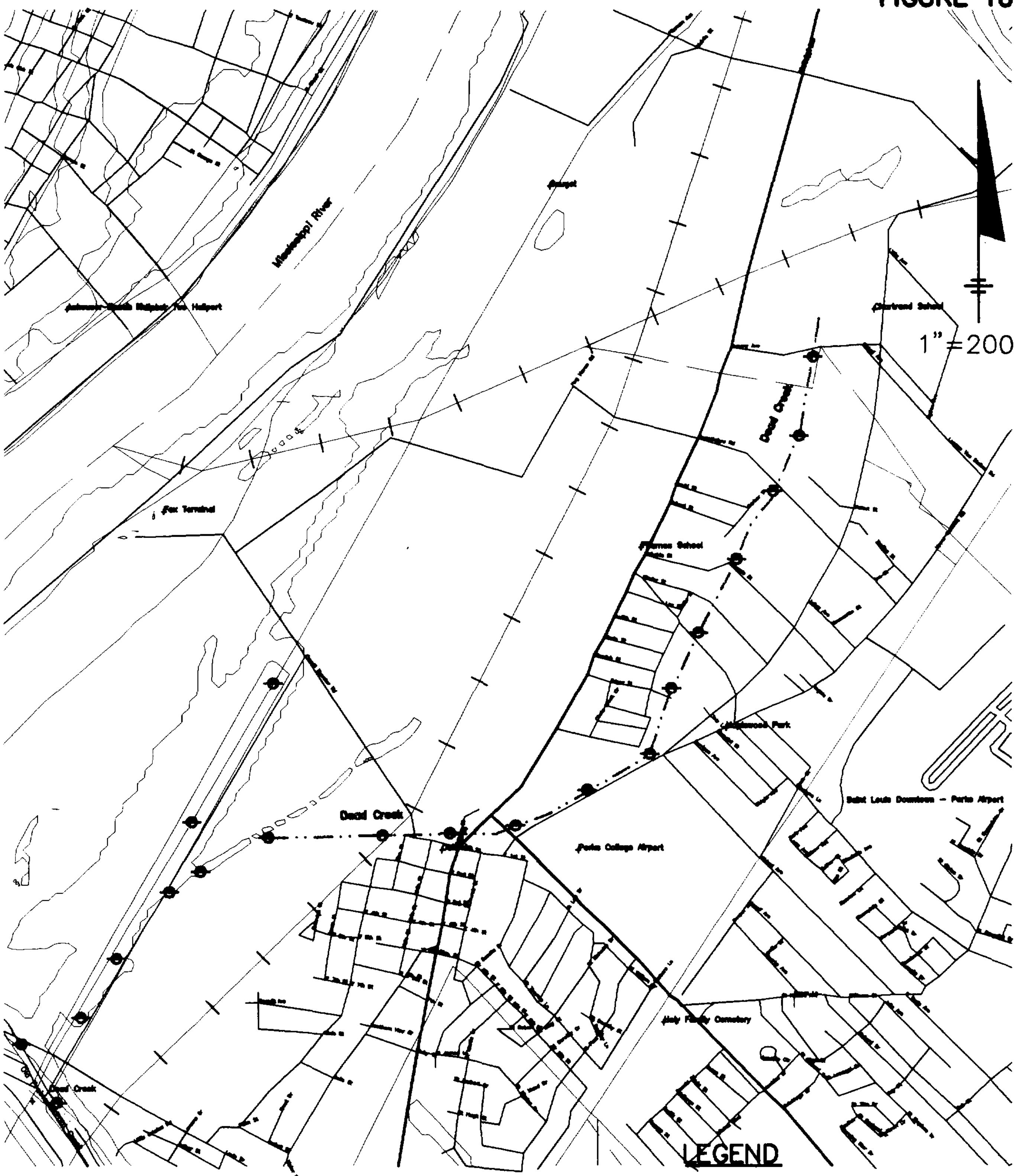
SURFACE WATER & SEDIMENT SAMPLING LOCATIONS
INDUSTRY-SPECIFIC CONSTITUENT MIGRATION

23548.010.03
3/29/99

ENGINEERS INC.

PLOT DATE:

FIGURE 10



LEGEND

SURFACE WATER & SEDIMENT SAMPLING STATION

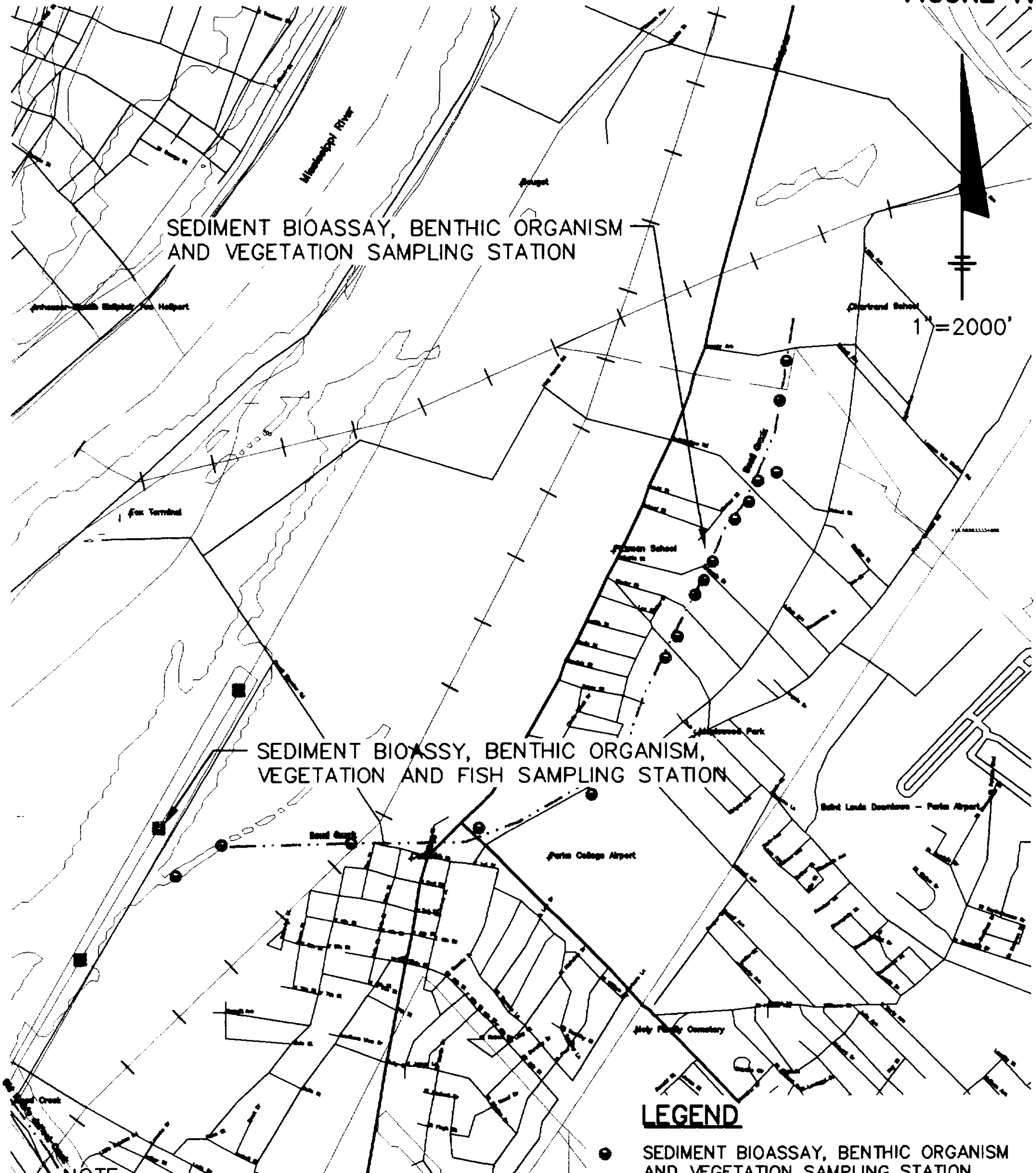
SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

SURFACE WATER & SEDIMENT SAMPLING LOCATIONS SITE-SPECIFIC CONSTITUENT MIGRATION

23548.010.02
3/29/99

O'BRIEN & GERE ENGINEERS INC.

FIGURE 11



LEGEND

● SEDIMENT BIOASSAY, BENTHIC ORGANISM AND VEGETATION SAMPLING STATION

■ SEDIMENT BIOASSY, BENTHIC ORGANISM, VEGETATION AND FISH SAMPLING STATION

NOTE:

REFERENCE AREA 1 AND 2 NOT SHOWN ON FIGURE.

SAUGET AREA 1 SUPPORT SAMPLING PLAN
SAUGET AND CAHOKIA, IL

ECOLOGICAL SAMPLING LOCATIONS

23548.010.01
3/29/99

ENGINEERS INC.

Appendix A

Preliminary Ecological Risk Assessment

Sauget Area 1, Creek Segment F

PRELIMINARY ECOLOGICAL RISK ASSESSMENT
FOR
SAUGET AREA 1, CREEK SEGMENT F
SAUGET, ST. CLAIR COUNTY, ILLINOIS
TDD: S05-9703-012
PAN: 7M1201SI

August 31, 1997

Prepared for:

UNITED STATES ENVIRONMENTAL PROTECTION AGENCY
Emergency and Enforcement Response Branch
77 West Jackson Boulevard
Chicago, Illinois, 60604

Prepared by: Damon M Sinars Date: 8/29/97
Damon Sinars, START Project Manager

Reviewed by: Date: 8/29/97
for Mary Jane Ripp, Assistant START Program Manager

Approved by: Date: 8/29/97
for Thomas Kouris, START Program Manager

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street, Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

recycled paper

Table of Contents

List of Figures

List of Tables

1. Introduction

The Ecology and Environment, Inc. (E & E), Superfund Technical Assessment and Response Team (START) was tasked by the United States Environmental Protection Agency (U.S. EPA) to prepare a screening-level ecological assessment for the Sauget Area 1, Creek Segment F site (the site) under the Superfund Removal Program Technical Direction Document S05-9703-012.

The following report summarizes preliminary findings regarding potential ecological risk at the site. This screening-level ecological assessment is based on information gathered during a site visit on April 18, 1997. The objective of this report is to determine whether the site poses no immediate or long-term ecological risk, or if a potential ecological risk exists and further evaluation is necessary.

2. Problem Formulation

2.1 Environmental Setting

2.1.1 Site Description

The site is a periodically flooded wetland, approximately 1 mile long. It is located in west-central St. Clair County, Illinois, directly across the Mississippi River from St. Louis, Missouri (Figure 2-1). The site is a drainage area for Dead Creek, which is an intermittent stream flowing south-southwest. Contaminated runoff that flows into Dead Creek may be deposited into the site. In order to isolate severe contamination, Dead Creek was blocked at Judith Lane, approximately 2 miles upstream from the site. Currently, a culvert exists at Judith Lane to allow flow during high water events. The creek then flows through the town of Cahokia, through a series of culverts, and enters the site area. Surface water leaves the site by outletting into the Prairie du Pont Floodway, then into the Cahokia Chute of the Mississippi River. The site is located immediately east of a United States Army Corps of Engineers flood control levee. The width of the flowing water on site varies with the season. The current assessment was conducted in April, during a relatively wet time of the year.

The land use surrounding the site and Dead Creek is a mix of industrial, agricultural, residential, and commercial. The nearby industrial areas consist of former municipal and industrial waste landfills, and excavation pits containing unknown industrial wastes. Several sites in the area have been investigated and cleaned by the Illinois Environmental Protection Agency (IEPA), U.S. EPA, and various consultants for the agencies or area industries. Railroad tracks exist to the east and to the west of site. Access to the northern portion of the site is unrestricted. Access to the southern portion of site is restricted by a fence to keep vehicles out, but not pedestrians. Some random dumping of household-type waste is evident in the area.

2.1.2 Site Assessment

On April 18, 1997, START members Damon Sinars and Donovan Robin conducted a site investigation with U.S. EPA On-Scene Coordinator (OSC) Samuel Borries. U.S. EPA Remedial Project Manager (RPM) Leah Evison, U.S. EPA Ecologist James Chapman, and IEPA Project Manager Paul Takacs.

2.1.3 Sensitive Habitats

During the assessment, U.S. EPA Ecologist Chapman investigated the habitat quality found on the site. Some of the findings are summarized below. Site features are shown in Figure 2-2 and photodocumentation is presented in Appendix A.

The site acts as a wooded corridor for Dead Creek. The corridor ranges in width from approximately 20 to 100 feet, and has a predominantly cottonwood overstory. The variation in corridor width may be partially attributed to upstream flooding due to beaver dams. The trees form a mostly closed canopy over the upstream portion of the site, but Dead Creek broadens downstream so that the canopy only covers the bank. The vegetation is of low floristic quality, consisting primarily of invasive and pioneer plants. This is consistent with the fact that the wetlands were drained and the woods were cleared prior to the 1930s, and the surrounding land is highly disturbed by agriculture and industry. However, the site does provide good quality wildlife habitat, as evidenced by its use by the Black-Crowned Night Heron, a state-listed endangered species. Also, there are plentiful detrital inputs (twigs, bark, and leaf litter) to the creek, which provides a substantial food base to benthic invertebrate populations. One limitation to the benthic invertebrate population is the lack of riffle areas and therefore, a potential for periods of low dissolved oxygen levels. A list of species identified on site is presented in Appendix B.

2.1.4 Endangered Species

One federally-listed threatened species is recorded in St. Clair County, the Decurrent False Aster, *Boltonia decurrens*. The preferred habitat of the plant is alluvial prairie and marshland in river floodplains (Herkert 1991). It is unlikely to occur on the site due to the history of extensive disturbance. Since the species flowers in September and October, the present survey provided no evidence regarding its potential occurrence at the site.

Several state-listed birds are likely to utilize the site. Only the Black-Crowned Night Heron was seen on site:

Black-Crowned Night Heron, *Nycticorax nycticorax* (endangered)
Little Blue Heron, *Florida (=Egretta) caerulea* (endangered)
Snowy Egret, *Egretta thula* (endangered)
Great Egret, *Casmerodius albus* (threatened)
Pied-Billed Grebe, *Podilymbus podiceps* (threatened)

2.2 Chemicals of Concern

2.2.1 Sampling Methods

During the site investigation, nine sediment samples (F101 through F109) (including one duplicate [F109] and one background [F107] sample) were collected at various locations in the wetland (Figure 2-3). Samples were two- or three-point composites obtained using either a corer or shovel, depending on sediment consistency and water depth. The first composite point at each sampling location was collected at the deepest portion of the channel, on the east side of the surface water body. The east side of the surface water body appeared to be more permanent than the central and west sides. The sediment was scooped out and placed into a stainless steel bowl. The second composite point was collected in the central or west portion of the surface water in an area where contaminants may have been deposited. It was placed in the same bowl and the sample was thoroughly mixed and placed into a sample jar. Sampling equipment/tools were deconned following each use. The samples were sent to EIS Analytical Services in South Bend, Indiana, for metal, polychlorinated biphenyl (PCB), polyaromatic hydrocarbon (PAH), pesticide, total organic carbon (TOC), and dioxin analyses under analytical TDD S05-9704-806.

2.2.2 Chemicals at the Site

Due to resource limitations, not every parameter was analyzed for every sample. In addition, only detected contaminants are reported in the tables. Analytical results are presented in Appendix C.

Since the primary goal of this assessment was to screen for human and ecological risk, the maximum detection level for each contaminant was used. These maximums were compared with benchmark criteria, including human health risk-based values for industrial soils (U.S. EPA 1993b) and the Ontario Provincial Sediment Quality Guidelines (Persaud, et al. 1993). Table 2-1 lists the maximum detection levels for the detected contaminants with the Sediment Quality Criteria (SQC) and a Hazard Quotient (HQ). SQC defines a Lowest Effect Level (LEL) and a Severe Effect Level (SEL) for individual contaminants, where enough information is available. LEL refers to marginally polluted sediments in which ecotoxic effects become apparent, but the majority of sediment-dwelling organisms are not affected. SEL refers to heavily polluted sediments likely to affect the health of sediment-dwelling organisms. HQ is a value equal to dose divided by guideline level. The HQ assists in identifying contaminants where severe risk potentially exists.

Results indicate that human health is not severely at risk. The maximum detections for all of the contaminants are below the human health risk-based values. When compared to ecological criteria, the data suggest contamination is a problem.

The metals data indicate that severe contamination exists from arsenic and cadmium (SEL HQs greater than 1) and minor pollution from chromium, lead, and mercury. All nine samples exceeded the SEL for arsenic (144 to 276 parts per million [ppm]), including the background which had the lowest level (144 ppm). Three samples exceeded the LEL for cadmium, one of which exceeded the SEL. The other samples, including the background, were "non detect" for cadmium. Three samples contained PCB Aroclor-1254, all of which were between the LEL and SEL. Only one sample (F105) contained PAHs. The four PAHs detected were similar to the LEL, but far below the SEL. The maximum concentration of dioxin detected exceeded the high risk concentration for both birds and mammals (Table 2-2). In addition, pesticides were not detected above background in any sample.

Sample F104 contained the highest metal concentrations; sample F102 contained the highest PCB and dioxin concentration; and sample F105 was the only sample to contain PAHs. The background sample (F107) contained the lowest concentration of each contaminant, except barium. The duplicate samples, F108 and F109, showed very similar results.

2.2.3 Assumptions and Uncertainty

This assessment is performed with the following conservative assumptions:

1) The Area Use Factor is 100%: the organism spends all of its time in the contaminated area, so is constantly exposed;

2) Bioavailability is 100%: Conditions do not limit the uptake or absorption of the contaminant;

3) The most sensitive life stage is present (e.g., early stage); and

4) Species feed entirely on the most contaminated dietary option.

Because this is a screening-level ecological risk assessment, uncertainty is intentionally assumed to be the worst-case scenario in order to not miss contamination that might be present.

2.2.4 Fate, Transport, and Ecotoxicity

A description of the sources, endpoints, and effects of the ecologically important contaminants found on site follows:

- Arsenic. Arsenic (As) is used in alloys, glass, wood preservatives, and pesticides. Pesticides were produced near the site. As an elemental metal, arsenic is highly persistent in air, water, soil, sediment, and all living tissues. Along with the possibility of being transported by runoff flowing into the stream and subsequently into the wetland, arsenic may be transported via atmospheric fallout (U.S. EPA 1978). Arsenic has been shown to strongly bioaccumulate in fish tissues and in freshwater molluscs. Arsenic appears to have relatively moderate aquatic and mammalian toxicity. A major concern with arsenic compounds is their strong mutagenic and carcinogenic potential (Ontario Ministry of the Environment [OMOE] 1992). Acute toxicity, as well as sublethal effects, have been observed in fish and invertebrates (National Oceanic and Atmospheric Administration [NOAA] 1991).

- Barium. Barium (Ba) is a naturally occurring element. High levels can decrease fecundity.

- Cadmium. Cadmium (Cd) is used principally in electroplating, batteries, pigments, plastic stabilizers, photovoltaic devices, and alloys. It is ubiquitous in the environment. Cadmium is of concern due to its high toxicity and bioavailability. High levels of cadmium are associated with high mortality, reduced growth, inhibited reproduction, and other adverse effects (NOAA 1991).

- Chromium. Chromium (Cr) is used in electroplating, steelmaking, photography, and some chemical syntheses. Chromium has been shown to bioaccumulate in fish (U.S. EPA 1978). Chromium inhibits growth in duckweed and algae, and reduces survival and fecundity in benthic macroinvertebrates. It is a carcinogen, teratogen, and mutagen (Eisler 1986).

- Lead. Potential sources of Lead (Pb) include mining, ore processing, smelting, refining, and exhaust emissions from combustion engines. Lead is used in construction material linings, X-ray and atomic radiation protection, storage batteries, solder and lead alloys, ceramics, plastics, electronic devices, and as a gasoline additive. Lead in soil is relatively unavailable to plants, except under acidic conditions, and the majority of the absorbed lead is retained in the root system. Because of the low availability to plants and internal immobility, phytotoxicity is rarely observed (Kabata-Pendias and Pendias 1992). Lead has shown moderate ability to bioaccumulate in fish (OMOE 1992). In animals, lead can modify the function and structure of kidneys, bones, the central nervous system, and the hematopoietic system (NOAA 1991). Lead poisoning in higher organisms primarily affects hematologic and neurologic processes. Lead can also impair growth, decrease fecundity, and increase mortality rates (Eisler 1988).

- Mercury. Mercury (Hg) is primarily used in electrical apparati, paint manufacturing, industrial instruments, dental preparations, and in the production of chlorine, caustics, catalysts, fungicides, bactericides, and pharmaceuticals. The effects of mercury bioaccumulation in fish and shellfish are well documented, as evident in consumption limitations in areas with mercury contamination. Methylmercury has been shown to be the hazardous form of mercury in edible tissues of fish. Bacteria common to most natural waters have been proven capable of converting many mercury compounds to methylmercury. Therefore, virtually any mercury compound entering water may become a bioaccumulation hazard if the environmental conditions are favorable for methylation (U.S. EPA 1978). Mercury displays very high acute toxicity to fish and other aquatic organisms. Mercury is the most toxic trace metal to aquatic organisms and that toxicity is increased in the presence of zinc and lead (NOAA 1991).

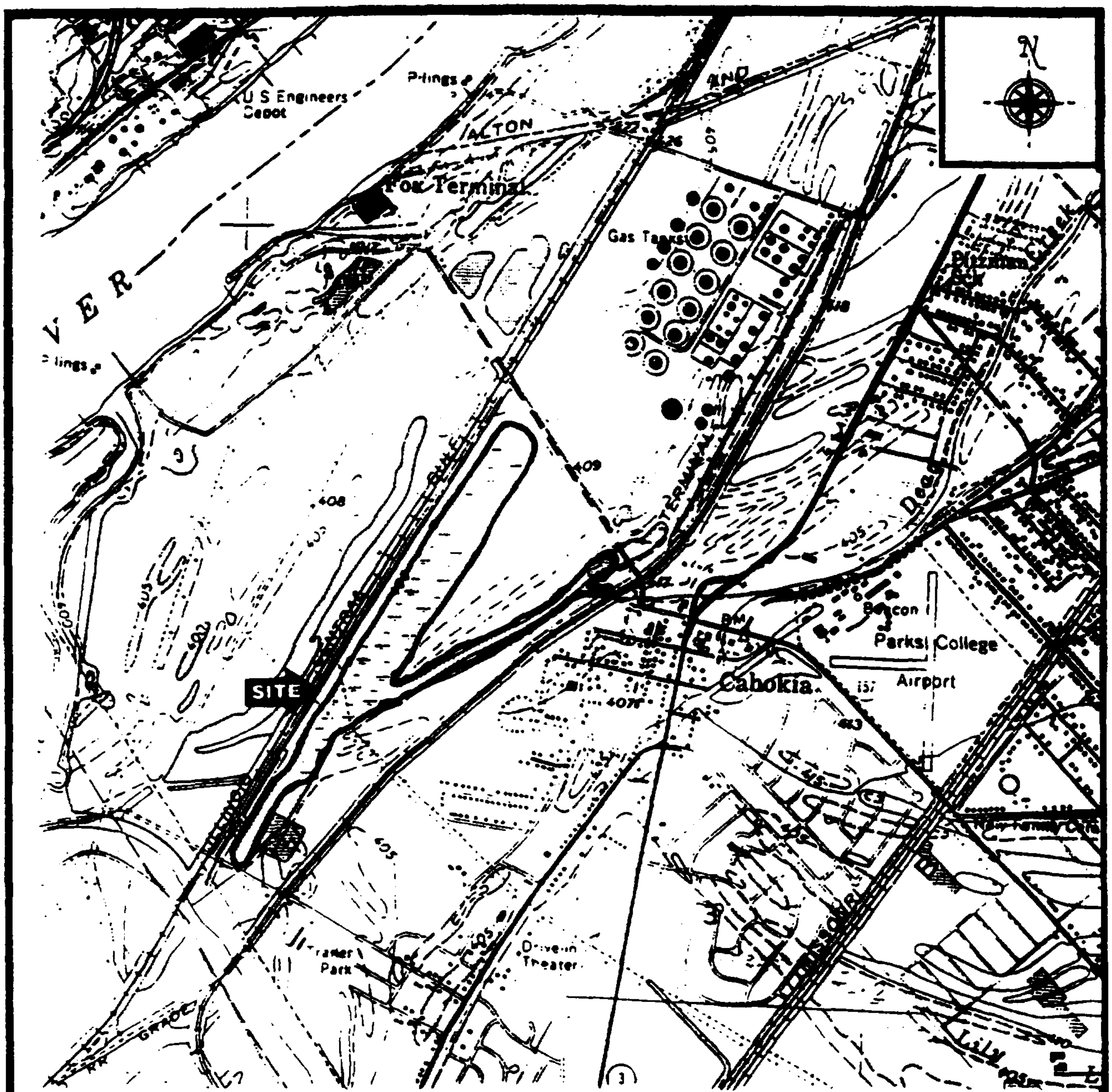
- PCBs. Polychlorinated biphenyls (PCBs) are chlorinated organic compounds that were once used for numerous purposes including as a dielectric fluid in electrical transformers. Current releases are from landfills containing PCB waste material, incineration of PCB-containing materials, and from improper disposal of materials, such as waste transformer fluids. PCBs are highly stable and cycle through the environment through evaporation, transport, deposition, and reevaporation. PCBs have been reported to bioconcentrate in fish tissues in the range of 1,076 to over 200,000 times. PCBs demonstrate very high acute and chronic toxicity to aquatic organisms, are well established as animal carcinogens, and are probable human carcinogens (OMOE 1992).

- PAHs. Polyaromatic hydrocarbons (PAHs) are semivolatile organic pollutants associated with emissions from the burning of fuels. PAHs have been reported to bioconcentrate in fish tissues. A number of PAHs demonstrate very high acute aquatic toxicity to freshwater invertebrates. Chronic aquatic toxicity is also relatively high. Some PAHs (e.g., benzo(a)pyrene) have been shown to be carcinogenic to experimental animals and are thought to be human carcinogens (OMOE 1992).

- Dioxin. Dioxin is a byproduct in the production of pesticides and herbicides, and can exist in soot, incinerator fly ash, and industrial wastes. Exceptionally low doses of this compound elicit a wide range of toxic responses in many animals, including: adverse reproductive effects, thymic atrophy, and a "wasting syndrome" leading to death (OMOE 1992). Dioxins are thought to be among the most potent animal carcinogens evaluated by U.S. EPA to date.

2.2.5 Interaction

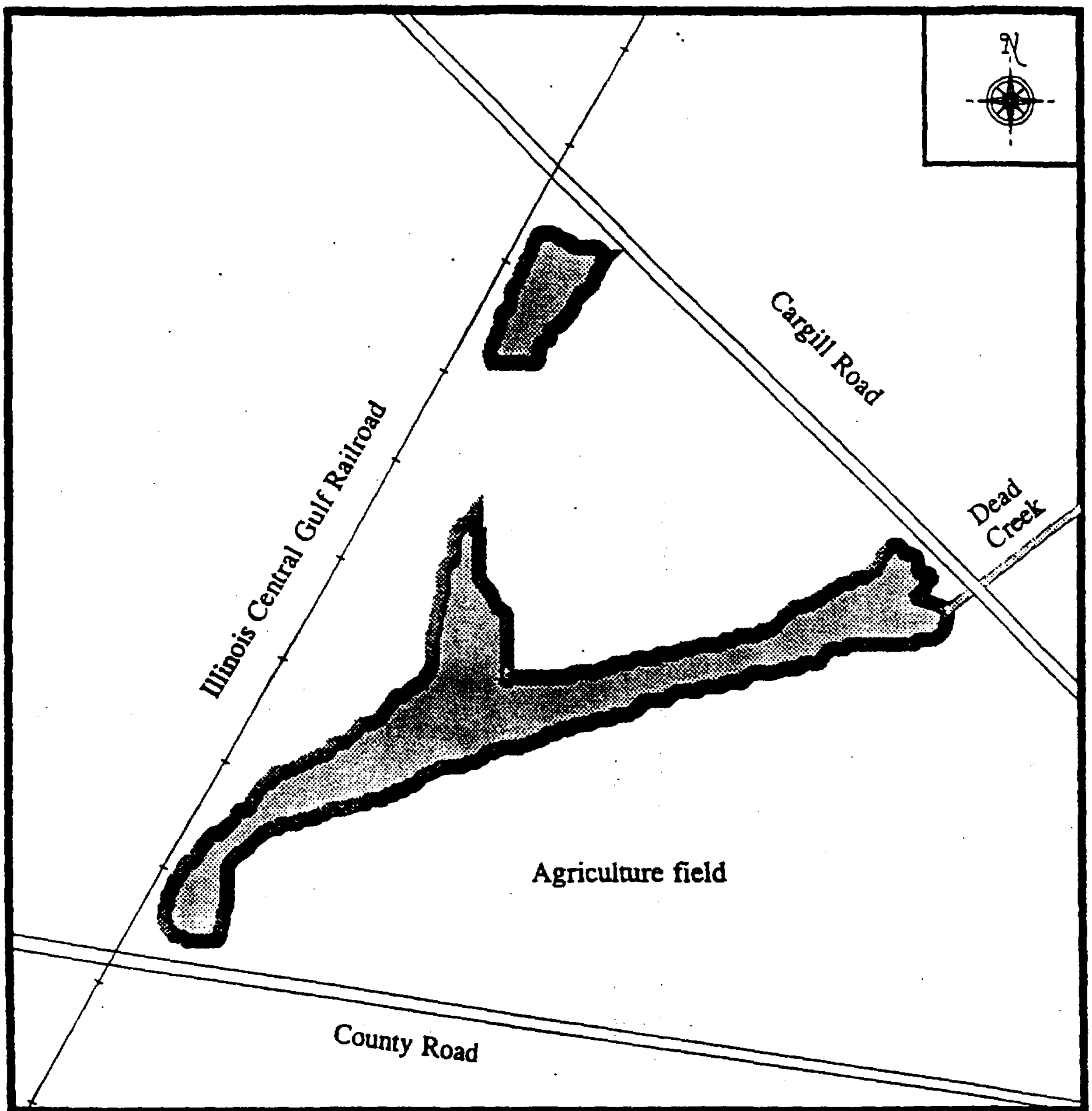
The presence of more than one contaminant may compound the harmful effects on an organism. For example, if a marginal level of lead and mercury both occur in one area, severe harmful effects on organisms may occur. Also, the presence of one contaminant may decrease the effectiveness an organism has with dealing with another contaminant.



Quadrangle Location

ecology and environment, inc.
Superfund Technical Assessment and Response Team
Region 5
33 North Dearborn Street, Chicago, Illinois 60602

TITLE	FIGURE #
Site Location Map	2-1
SITE Sauget Area 1	SCALE 1:24000
CITY Sauget STATE Illinois	TDD S05-9703-012
SOURCE USGS Topographical Map, 7.5' Series Quadrangle: Cahokia, Illinois	DATE 1980

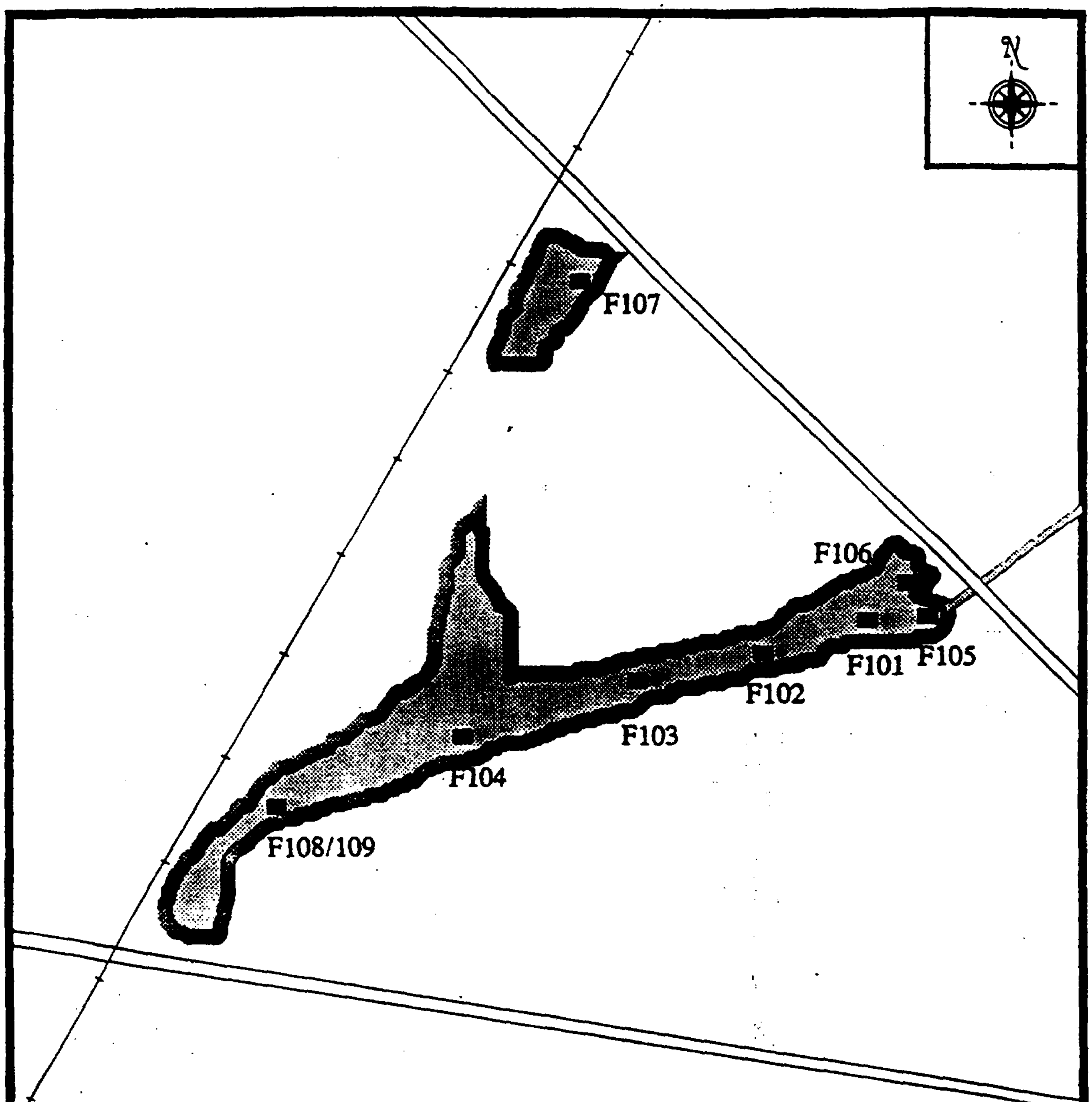


Legend

- Trees and shrubs
- Wetland
- Railroad

ecology and environment, inc.
Superfund Technical Assessment and Response Team
Region 5
33 North Dearborn Street, Chicago, Illinois 60602

TITLE Site Features Map			FIGURE # 2-2
SITE Sauget Area 1			SCALE Not to scale
CITY Sauget	STATE Illinois		TDD S05-9703-012
SOURCE Ecology and Environment, Inc.			DATE 1997



Legend

■ Sample location

ecology and environment, inc.
Superfund Technical Assessment and Response Team
Region 5
33 North Dearborn Street, Chicago, Illinois 60602

TITLE Sample Location Map	FIGURE # 2-3
SITE Sauget Area 1	SCALE Not to scale
CITY Sauget STATE Illinois	TDD S05-9703-012
SOURCE Ecology and Environment, Inc.	DATE 1997

Table 2-1

COMPARISON OF SITE SEDIMENT DATA WITH NONREGULATORY SEDIMENT QUALITY CRITERIA
SAUGET AREA 1
SAUGET, ILLINOIS
APRIL 18, 1997

Parameter	Maximum Detection[a] (mg/kg)	Risk-Based Level[b] (mg/kg)	SQC (mg/kg)		Hazard Quotient[c] (no units)	
			LEL	SEL	LEL	SEL
Arsenic	276	310	6.0	33.0	46.0	8.4
Barium	228	72,000	NA	NA	NA	NA
Cadmium	16.3	510	0.6	10.0	27.2	1.6
Chromium	44.2	5,100	26.0	110	1.7	0.4
Lead	199	NA	31.0	250	6.4	0.8
Mercury	0.55	310	0.2	2.0	2.8	0.3
Aroclor-1254	2.1	NA	0.06	34.0	35.0	0.1
Benzo(b)fluoranthene	0.63	3.9	NA	NA	NA	NA
Benzo(g,h,i)perylene	0.52	NA	0.170	320	3.1	0.0
Fluoranthene	0.62	41,000	0.750	1020	0.8	0.0
Indeno(1,2,3-cd)pyrene	0.50	NA	0.200	320	2.5	0.0

Key:

[a] = Refers to the highest level of contaminant detected in the samples collected during the assessment.

[b] = Human health risk-based concentrations for industrial soil (U.S. EPA 1993b).

[c] = Sample concentration/SQC.

SQC = Sediment Quality Criteria: Based on the Ontario Provincial Sediment Guidelines (Persaud, et al. 1994).

LEL = Lowest Effect Level: Refers to marginally polluted sediments in which ecotoxic effects become apparent, but the majority of sediment-dwelling organisms are not affected.

SEL = Severe Effect Level: Refers to heavily polluted sediments likely to affect the health of sediment-dwelling organisms.

mg/kg = Milligrams per kilogram.

NA = Not available.

Source: EIS Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

Table 2-2

COMPARISON OF SITE SEDIMENT DIOXIN DATA WITH NONREGUALTORY ECOLOGICAL RISK CRITERIA[a]
SAUGET AREA 1
SAUGET, ILLINOIS
APRIL 18, 1997

Maximum Detection[b] (pg/g)	Avian Risk (pg/g)		Hazard Quotient[c] (no units)		Mammalian Risk (pg/g)		Hazard Quotient[c] (no units)	
	Low	High	Low	High	Low	High	Low	High
211	21	210	10.0	1.0	2.5	25.0	84.4	8.4

Key:

[a] = The analytical results for dioxin listed in this table were converted to dioxin 2,3,7,8-TCDD equivalent. This maximum detection is compared with sediment benchmark values obtained from U.S. EPA 1993. The values listed under "Low" represent a concentration derived from no-effects thresholds for reproductive effects in avian and mammalian wildlife. The values under "High" represent a concentration derived from doses expected to cause 50 to 100% mortality in embryos and young of sensitive avian and mammalian species.

[b] = Refers to the highest level of contaminant detected in the samples collected during the assessment.

[c] = Sample concentration/risk value.

pg/g = Picograms per gram.

Source: EIA Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

3. Conclusions and Recommendations

Based on this investigation, site contamination does not appear to threaten human health. Sediment contamination levels are below the risk-based values and few people enter the site boundaries.

Elevated levels of metals and PCBs may be highly detrimental to the ecology of this site. The presence of arsenic, cadmium, and dioxin greater than the SEL guideline may decrease the species richness of the area. Sensitive species, including the endangered Black-Crowned Night Heron, inhabit the site and therefore, are subject to effects such as acute toxicity, reduced growth, inhibited reproduction, and other adverse effects. Finally, species that feed on contaminated organisms may bioaccumulate the contaminants and become adversely affected.

The contamination on the site warrants further investigation and possible remediation, especially because it provides high quality wetland habitat.

4. References

Bohlen, H., 1989, *The Birds of Illinois*, Indiana University Press, Bloomington, Indiana.

Chapman, J., June 3, 1997, personal communication, Ecologist, Technical Support Section, U.S. EPA Region 5, Memorandum to Damon Sinars, Ecology and Environment, Inc., Chicago, Illinois.

Conant, R. and J. Collins, 1991, *A Field Guide to Reptile and Amphibians, Eastern and Central North America*, Third Ed., Houghton Mifflin Co., Boston, Massachusetts.

Dunn, G., 1996, *Insects of the Great Lakes Region*, University of Michigan Press, Ann Arbor, Michigan.

Eisler, R., 1986, Chromium Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, *Biological Report* 85(1.6), U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Eisler, R., 1988, Lead Hazards to Fish, Wildlife, and Invertebrates: A Synoptic Review, *Biological Report* 85(1.6), U.S. Department of the Interior, Fish and Wildlife Service, Washington, D.C.

Gleason, H.A. and A. Cronquist, 1991, *Manual of Vascular Plants of Northeastern United States and Adjacent Canada*, Second Ed., New York Botanical Garden, Bronx, New York.

Herkert, J., 1991, *Endangered and Threatened Species of Illinois: Status and Distribution*, Vol. 1 - Plants, Illinois Endangered Species Protection Board, Springfield, Illinois.

Kabata-Pendias, A. and H. Pendias, 1992, *Trace Elements in Soils and Plants*, Second Ed., CRC Press, Boca Raton, California.

Kurta, A., 1995, *Mammals of the Great Lakes Region*, Revised Ed., University of Michigan Press, Ann Arbor, Michigan.

National Oceanic and Atmospheric Administration (NOAA), 1991, The Potential for Biological Effects of Sediment-sorbed Contaminants Tested in the National Status and Trends Program, Technical Memorandum, NOS OMA 52.

Ontario Ministry of the Environment (OMOE), 1992, Candidate Substance List for Bans or Phase-outs, PIBS 1921E, Ontario, Canada.

Persuad, D., J. Jaagumagi, and A. Hayton, 1993, Guidelines for the Protection and Management of Aquatic Sediment Quality in Ontario, PIBS 1962, Ministry of Environment and Energy, Toronto, Ontario, Canada.

Peterson, R., 1980, *A Field Guide to the Birds of Eastern and Central North America*, Houghton Mifflin Co., Boston, Massachusetts.

U.S. EPA, 1978, Metal Bioaccumulation in Fishes and Aquatic Invertebrates: A Literature Review, EPA-600-3-78-103.

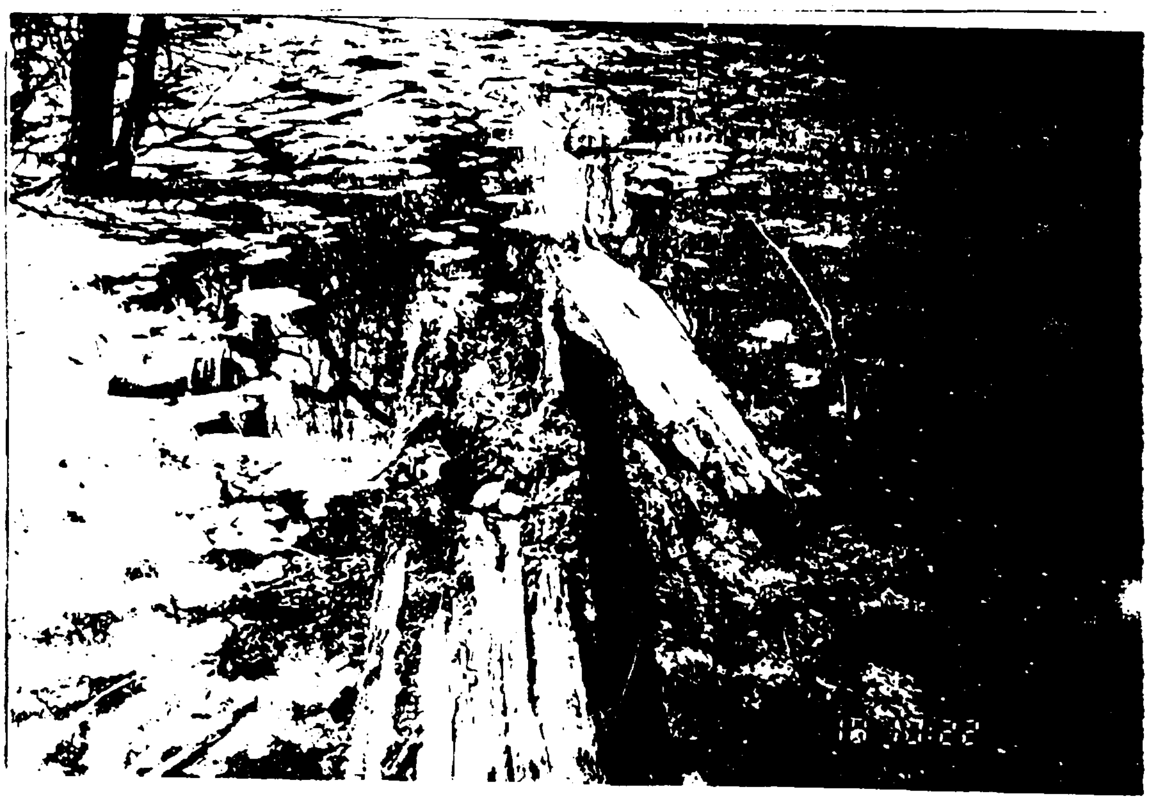
U.S. EPA, 1993, Interem Report on Data and Methods for Assessment of 2,3,7,8-tetrachlorodibenzo-p-dioxin Risks to Aquatic Life and Associated Wildlife, EPA-600-R-93-055.

U.S. EPA, 1993b, Risk-based Concentration Table, Third Quarter 1993, July 9 Memorandum from Roy L. Smith, Technical Support Section, Region 3, Philadelphia, Pennsylvania.

Appendix A

Photodocumentation

SITE NAME: Sauget Area 1 **TDD:** S05-9703-012 **PHOTOGRAPHER:** D. Sinars
DATE: April 18, 1997 **TIME:** 0859 **DIRECTION:** Southwest
SUBJECT: Area where Dead Creek flows into wetland.



SITE NAME: Sauget Area 1 **TDD:** S05-9703-012 **PHOTOGRAPHER:** S. Borries
DATE: April 18, 1997 **TIME:** 1022 **DIRECTION:** North
SUBJECT: Canada geese nest and bucket near sample F101.

SITE NAME: Sauget Area 1 **TDD:** S05-9703-012 **PHOTOGRAPHER:** D. Robin
DATE: April 18, 1997 **TIME:** 1031 **DIRECTION:** West
SUBJECT: START Sinars using shovel to sample F102; evidence of beavers in background.

SITE NAME: Sauget Area 1 **TDD:** S05-9703-012 **PHOTOGRAPHER:** D. Robin
DATE: April 18, 1997 **TIME:** 1215 **DIRECTION:** North
SUBJECT: START Sinars using a corer to sample F106; debris along Cargill Road in background.

Appendix B

Species List

The following species list was compiled based on observations made by James Chapman, Ph.D., Ecologist, Technical Support Section of Region 5 U.S. EPA, during the assessment of Sauget Area 1, Creek Segment F on April 18, 1997 (Chapman 1997). This is not a comprehensive biological survey. Species listed are the common, obvious species encountered near the site in early spring. Species names are based on the following texts: plants, Gleason and Cronquist 1991; birds, Peterson 1980 and Bohlen 1989; mammals, Kurta 1995; herptiles, Conant and Collins 1991; and insects, Dunn 1996 (see References, Section 4).

<u>Aquatic Vegetation</u>:

Lesser Duckweed, *Lemna minor*
Unidentified filamentous green algae and periphyton

<u>Aquatic Insects</u>:

Water Boatman (*Corixidae*)

<u>Herptiles</u>:

Painted Turtles, *Chrysemys picta* (approximately 100, sunning on the northeast wetland extension above the confluence with Dead Creek)

<u>Aquatic Birds</u>:

Black-Crowned Night Heron, *Nycticorax nycticorax*, a state-listed endangered species (three individuals at the northeast wetland extension above the confluence with Dead Creek)
Belted Kingfisher, *Megaceryle salcyon*
Canada Goose, *Branta canadensis* (nesting pair near confluence, flock on northwest backwater)
American Coot, *Fulica americana*

<u>Riparian/Terrestrial Vegetation</u>:

Cottonwood, *Populus deltoides* (dominant overstory species)
Boxelder, *Acer negundo*
Silver Mapel, *Acer saccharinum*
Sycamore, *Plantanus occidentalis*
Elm, *Ulmus* sp. (saplings)
Wild Black Cherry, *Prunus serotina*
Dogwood, *Cornus* sp.
Willow, *Salix* spp.
Nettle, *Urtica* sp.
Bramble, *Rubus* sp.
Poison Ivy, *Toxicodendron radicans*
Grape, Vitis sp.
Trumpet-creeper, *Campsis radicans*

Riparian/Terrestrial Vegetation, continued:

Onion, *Allium* sp.
Cleavers, *Galium aparine*
Horsetail, *Equisetum* sp.
Gill-over-the-ground, *Glechoma hederacea*
Dooryard (common blue) violet, *Viola sororia* (=*papilionacea*)
Wild White Violet, *Viola macloskeyi* (=*pallens*)
Field Penny-Cress, *Thlaspi arvense*
Short-Spurred Corydalis, *Corydalis flavula*
Sedges (*Cyperaceae*)

Birds:

Red-Winged Blackbirds, *Agelaius phoeniceus*
Robin, *Turdus migratorius*
Northern Cardinal, *Cardinalis cardinalis*
White-Throated Sparrow, *Zonotrichia albicollis*
Mourning Dove, *Zenaida macroura*
Common Flicker, *Colaptes auratus*
Blue-Gray Gnatcatcher, *Polioptila caerulea*

Mammals:

American Beaver, *Castor canadensis* (dam and vegetation marks)
White-Tailed Deer, *Odocoileus virginianus*
Common Raccoon, *Procyon lotor* (tracks)
Red Fox, *Vulped vulpes* (tracks)
Domestic Dog, *Canis familiaris* (tracks)

Appendix C

Analytical Results

- Data Summary Tables
  - C-1: Metals Data Summary
  - C-2: PCB Data Summary
  - C-3: PAH Data Summary
  - C-4: Dioxin Data Summary
- Data Validation Memoranda
- Laboratory Analytical Package

Table C-1

METALS DATA SUMMARY
SAUGET AREA 1
SAUGET, ILLINOIS
APRIL 18, 1997
(units = mg/kg)

Sample	Parameter							
	Arsenic	Barium	Cadmium	Chromium	Lead	Mercury	Selenium	Silver
F101	232	145	ND	44.2	41.2	ND	ND	ND
F102	187	162	4.56	29.0	199	0.24	ND	ND
F103	213	179	8.29	43.8	111	0.30	ND	ND
F104	276	228	16.3	27.2	124	0.55	ND	ND
F105	166	116	ND	12.6	56.2	ND	ND	ND
F106	160	133	ND	12.1	28.3	ND	ND	ND
F107	144	137	ND	10.4	28.2	ND	ND	ND
F108	199	138	ND	14.9	45.7	0.12	ND	ND
F109	160	163	ND	13.9	50.2	0.11	ND	ND

Key:
ND = Non detect.
mg/kg = Milligrams per kilogram.

Source: EIS Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

Table C-2 PCB DATA SUMMARY SAUGET AREA 1 SAUGET, ILLINOIS APRIL 18, 1997 (units = mg/kg)			
Sample	Parameter		
	PCB-1254	PCB-1248	PCB-1260
F101	ND	ND	ND
F102	2.1	ND	ND
F103	0.50	ND	ND
F104	0.52	ND	ND
F105	ND	ND	ND
F106	ND	ND	ND
F107	ND	ND	ND
F108	ND	ND	ND

Key:
ND = Non detect.
mg/kg = Milligrams per kilogram.

Source: EIS Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

Table C-3 PAH DATA SUMMARY SAUGET AREA 1 SAUGET, ILLINOIS APRIL 18, 1997 (units = mg/kg)	
Parameter	**Sample F105**
Benzo(b)fluoranthene	0.63
Benzo(ghi)perylene	0.52
Fluoranthene	0.62
Indeno(1,2,3-cd)pyrene	0.50

Key:
mg/kg = Milligrams per kilogram.

Source: EIS Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

Table C-4 DIOXIN DATA SUMMARY[a] SAUGET AREA 1 SAUGET, ILLINOIS APRIL 18, 1997 (units = pg/g)	
Sample	**Concentration**
F301	11.5
F302	211
F305	53.4
F307	2.29

Key:
[a] = Dioxin results were converted to dioxin 2,3,7,8-TCDD equivalent.
pg/g = Picograms per gram.

Source: EIS Analytical Services, South Bend, Indiana; Analytical TDD S05-9704-806.

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street
Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

M E M O R A N D U M

DATE: June 23, 1997

TO: Damon Sinars, START Project Manager, E & E, Chicago, Illinois

FROM: Lisa Graczyk, START Chemist, E & E, Chicago, Illinois

THROUGH: Dave Hendren, START Analytical Services Manager, E & E, Chicago, Illinois

SUBJECT: Data Quality Review for Polynuclear Aromatic Hydrocarbons (PAH), Sauget Area One, Sauget, St. Clair County, Illinois

REFERENCE: Project TDD S05-9703-012 Analytical TDD S05-9704-806
Project PAN 7M1201SIXX Analytical PAN 7AAF01TAXX

The data quality assurance (QA) review of five sediment samples collected from the Sauget Area One site is complete. The samples were collected on April 18, 1997, by the Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. (E & E). The samples were submitted to EIS Analytical Services, Inc., South Bend, Indiana, for analyses. The laboratory analyses were performed according to the following United States Environmental Protection Agency (U.S. EPA) Solid Waste 846 Methods: 3540 for extraction; and 8270 for PAH analysis.

Sample Identification

START Identification No.	Laboratory Identification No.
F101	042083
F102	042084
F105	042087
F106	042088
F107	042089

Data Qualifications:

I. Sample Holding Time: Acceptable

The samples were collected on April 18, 1997. The samples were extracted on April 23, 1997 and analyzed on April 24, 1997. This is within the 14-day holding time limit, from collection to extraction, and 40-day limit from extraction to analysis.

II. Gas Chromatography/Mass Spectrometry (GC/MS) Tuning: Acceptable

GC/MS tuning to meet ion abundance criteria using decaflurotriphenylphosphine (DFTPP) was acceptable and samples were analyzed within 12 hours of DFTPP tuning.

III. Calibrations:

- Initial Calibration: Acceptable

A five-point initial calibration was performed prior to analysis. All target compounds had relative response factors of at least 0.05. The percent relative standard deviations (%RSDs) between response factors were less than 30% for all target compounds.

- Continuing Calibration: Acceptable

The percent differences of the response factors were less than 25%, as required for target compounds.

IV. Blank: Acceptable

A method blank was analyzed with the samples. No target compounds were detected in the blank.

V. Internal Standards: Acceptable

The areas of the internal standards in the samples were within -50% to +100% of the associated calibration check standards. The retention times of the internal standards were within the 30-second control limit.

VI. Compound Identification: Acceptable

The mass spectra and retention times of the detected compounds in the samples matched those of the standards.

VII. Overall Assessment of Data for Use: Acceptable

The overall usefulness of the data is based on criteria for QA Level II as outlined in the Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01 (April 1990), Data Validation Procedures, Section 4.0, BNAs by GC/MS Analysis. Based upon the information provided, the data are acceptable for use.

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street
Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

M E M O R A N D U M

DATE: June 23, 1997

TO: Damon Sinars, START Project Manager, E & E, Chicago, Illinois

FROM: Lisa Graczyk, START Chemist, E & E, Chicago, Illinois

THROUGH: Dave Hendren, START Analytical Services Manager, E & E, Chicago, Illinois

SUBJECT: Data Quality Review for Polychlorinated Biphenyls (PCBs) and Pesticides, Sauget Area One, Sauget, St. Clair County, Illinois

REFERENCE: Project TDD S05-9703-012 Analytical TDD S05-9704-806
Project PAN 7M1201SIXX Analytical PAN 7AAF01TAXX

The data quality assurance (QA) review of nine sediment samples collected from the Sauget Area One site is complete. The samples were collected on April 18, 1997, by the Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. (E & E). The samples were submitted to EIS Analytical Services, Inc, South Bend, Indiana, for analyses. The laboratory analyses were performed according to the United States Environmental Protection Agency (U.S. EPA) Solid Waste 846 Methods 3540B for extraction and 8081 for PCB/Pesticide analysis.

Sample Identification

START Identification No.	Laboratory Identification No.	Parameter
F101	042083	PCBs
F102	042084	PCB/Pesticides
F103	042085	PCB/Pesticides
F104	042086	PCB/Pesticides
F105	042087	PCBs
F106	042088	PCBs
F107	042089	PCB/Pesticides
F108	042090	PCBs
F109	042091	PCBs

Data Qualifications:

I. Sample Holding Time: Acceptable

The samples were collected on April 18, 1997, extracted on April 24, 1997, and analyzed on April 25 and 26, 1997. This is within the 14-day holding time limit, from collection to extraction, and 40-day limit from extraction to analysis.

II. Instrument Performance: Acceptable

The chromatographic resolution was adequate in the standard and sample chromatograms. DDT retention time was greater than 12 minutes in the standard chromatograms. Retention time windows were reported and standards were in the established windows. Surrogate retention times were consistent in the samples and standards.

III. Calibrations:

- Initial Calibration: Acceptable

A five-point initial calibration was performed prior to analysis. The percent relative standard deviations (%RSD) of calibration factors in the initial linearity check were less than 20%.

- Continuing Calibration: Acceptable

The percent differences of the response factors were less than 15% for detected compounds.

IV. Blank: Acceptable

A method blank was analyzed with the sample. No target compounds or contaminants were detected in the blank.

V. Compound Identification: Acceptable

Detected PCBs in the samples appeared to match the "fingerprint" pattern of the standard chromatograms and were confirmed on a second GC column.

VI. Additional QC Checks: Acceptable

The surrogate recoveries were within the control limits established by the laboratory.

VII. Overall Assessment of Data for Use: Acceptable

The overall usefulness of the data is based on criteria for QA Level II as outlined in the Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01 (April 1990), Data Validation Procedures, Section 6.0, Pesticides/PCBs. Based upon the information provided, the data are acceptable for use.

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street
Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

M E M O R A N D U M

DATE: June 23, 1997

TO: Damon Sinars, START Project Manager, E & E, Chicago, Illinois

FROM: Lisa Graczyk, START Chemist, E & E, Chicago, Illinois

THROUGH: Dave Hendren, START Analytical Services Manager, E & E, Chicago, Illinois

SUBJECT: Inorganic Data Quality Review for Resource Conservation and Recovery Act (RCRA) Metals, Sauget Area One, Sauget, St. Clair County, Illinois

REFERENCE: Project TDD S05-9703-012 Analytical TDD S05-9704-806
Project PAN 7M1201SIXX Analytical PAN 7AAF01TAXX

The data quality assurance (QA) review of nine sediment samples collected from the Sauget Area One site is complete. The samples were collected on April 18, 1997, by the Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. (E & E). The samples were submitted to EIS Analytical Services, Inc., South Bend, Indiana, for analyses. The laboratory analyses were performed according to U.S. EPA solid Waste 846 Methods: 3005A for sample digestion; 6010 for arsenic, barium, cadmium, chromium, lead, selenium, and silver; and 7471 for mercury.

Sample Identification

START Identification No.	Laboratory Identification No.
F101	042083
F102	042084
F103	042085
F104	042086
F105	042087
F106	042088
F107	042089
F108	042090
F109	042091

Data Qualifications:

I. Sample Holding Time: Acceptable

The samples were collected on April 18, 1997, and analyzed between April 28 and May 1, 1997. This is within the six month holding time limit (28 days for mercury).

II. Calibration:

- Initial Calibration: Qualified

  Recoveries for the initial calibration verification were within 90 to 110% for analytes other than mercury, as required. Recoveries for mercury were not within the established limits of 80% to 120%. All positive results for mercury were flagged as "J" or estimated, as required.

- Continuing Calibration: Qualified

  All analytes included in the continuing calibration verification standard were within 90 to 110% other than mercury, as required. The recovery for mercury was 77.5% wich is outside the control limits of 80% to 120%. All positive results for mercury were flagged as "J" or estimated, as required.

III. Blanks: Acceptable

Calibration and preparation blanks were analyzed with each analytical batch. No target analytes were detected in the blanks. At least one blank was analyzed for each 20 samples.

IV. Interference Check Samples (ICSs): Acceptable

ICSs were analyzed and recoveries were acceptable.

V. Overall Assessment of Data for Use: Acceptable

The overall usefulness of the data is based on criteria for QA Level II as outlined in the Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01 (April 1990) Data Validation Procedures, Section 3.0, Metallic Inorganic Parameters. Based upon the information provided, the data are acceptable for use.

Data Qualifiers and Definitions:

J - The associated numerical value is an estimated quantity because the reported concentrations were less than the required detection limits or quality control criteria were not met.

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street
Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

M E M O R A N D U M

DATE: June 20, 1997

TO: Damon Sinars, START Project Manager, E & E, Chicago, Illinois

FROM: Lisa Graczyk, START Chemist, E & E, Chicago, Illinois

THROUGH: Dave Hendren, START Analytical Services Manager, E & E, Chicago, Illinois

SUBJECT: Miscellaneous Data Quality Review for Total Organic Carbon (TOC), Sauget Area One, Sauget, St. Clair County, Illinois

REFERENCE: Project TDD S05-9703-012 Analytical TDD S05-9704-806
Project PAN 7M1201SIXX Analytical PAN 7AAF01TAXX

The data quality assurance (QA) review of three sediment samples collected from the Sauget Area One site is complete. The samples were collected on April 18, 1997, by the Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. (E & E). The samples were submitted to EIS Analytical Services, Inc., South Bend, Indiana. The laboratory analyses were performed according to United States Environmental Protection Agency (U.S. EPA) Solid Waste 846 method 9060 which was modified for sediment analysis.

Sample Identification

START Identification No.	Laboratory Identification No.
F102	042084
F103	042085
F104	042086

Data Qualifications:

I. Sample Holding Time: Acceptable

The samples were collected on April 18, 1997 and analyzed on April 25, 1997. The Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01 (April 1990) and SW846 method 9060 do not provide a holding time for TOC in sediments.

II. Calibrations: Acceptable

Method 9060 states to follow the instrument manufacturer's instructions on calibrating the instrument. No control limits are mentioned. The laboratory analyzed an initial calibration verification standard both before and after the analysis. The percent differences between true and received results were 3% and 5% respectively. This is acceptable.

III. Blanks: Acceptable

A blank was analyzed both before and after the analysis. No contaminants were found in the blank.

IV. Overall Assessment of Data for Use: Acceptable

The overall usefulness of the data is based on criteria for QA Level II as outlined in Data Validation Procedures, Section 9.0, Generic Data Validation Procedures as stated in OSWER Directive 9360.4-01 (April 1990). Based upon the information provided, the data are acceptable for use.

[redacted]

Mr David Hendren
Ecology & Environment, Inc.
33 North Dearborn, Suite 900
Chicago, IL 60602
Tel No: 312-578-9243
Fax No: 312-578-9345
PO No:
Project Name: Sauget Area

Report Date:	5/22/97
EIS Order No:	970400209
EIS Sample No:	042083
EIS Project No:	2009-1000-97
Client Sample ID:	F101
Date Collected:	4/18/97
Date Received:	4/22/97
Collected By:	DMS

This report presents results of analysis for your sample(s) received under our Order No above. This Number is to be used in all inquiries concerning this report. The EIS Sample No above, as well as your Sample ID, refer to the first sample in a multi-sample submission.

DEFINITIONS:
MDL = Method Detection Limit normally achieved in the absence of interferences or other matrix difficulties.
SDL = Sample Detection Limit achieved in your sample. If numerically greater than the MDL, dilutions were required in order to perform the analysis. If numerically less than the MDL, alternate techniques were employed.

CHAIN-OF-CUSTODY is enclosed if received with your sample submission.

QUALITY ASSURANCE OFFICER

LABORATORY DIRECTOR

The data in this report has been reviewed and complies with EIS Quality Control unless specifically addressed above.

SAMPLE RESULTS

CLIENT SAMPLE ID: F101
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042083
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	232	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	145	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	44.2	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	41.2	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	<0.1	mg/kg(wet)	0.1	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F101
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042083
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Acenaphthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Acenaphthylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(b)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(ghi)perylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(k)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Chrysene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Dibenzo(a,h)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluorene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Indeno(1,2,3-cd)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Naphthalene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	827[illegible]
Phenanthrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270
Pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B

SAMPLE RESULTS

CLIENT SAMPLE ID:	F101	Report Date:	5/22/97
Date Collected:	4/18/97	EIS Sample No:	042083
Date Received:	4/22/97	EIS Order No:	970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	KlepperW	4/25/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F102
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042084
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Total Organic Carbon (TOC)	26800	mg/kg(wet)	5	5	BaunG	4/28/97	9060 M

SAMPLE RESULTS

CLIENT SAMPLE ID: F102
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042084
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	187	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	162	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	4.56	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	29.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	199	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	0.24 J	mg/kg(wet)	0.1	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F102
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042084
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Acenaphthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Acenaphthylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(b)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(ghi)perylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(k)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Chrysene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Dibenzo(a,h)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluorene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Indeno(1,2,3-cd)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Naphthalene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270
Phenanthrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270
Pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B

SAMPLE RESULTS

CLIENT SAMPLE ID:	F102	**Report Date:**	5/22/97
Date Collected:	4/18/97	**EIS Sample No:**	042084
Date Received:	4/22/97	**EIS Order No:**	970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1221)	nd	mg/kg(wet)	1	0.2	CarmichaelJ	4/26/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1254)	2.1	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.5	0.1	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F102
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042084
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Aldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(alpha)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(gamma)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Dieldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan I	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan II	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan sulfate	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin aldehyde	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin ketone	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Heptachlor	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (alpha-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (beta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (delta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (gamma-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Methoxychlor	nd	mg/kg(wet)	0.25	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDD	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDE	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDT	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Toxaphene	nd	mg/kg(wet)	2.5	0.2	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID:	F103	**Report Date:**	5/22/97
Date Collected:	4/18/97	**EIS Sample No:**	042085
Date Received:	4/22/97	**EIS Order No:**	970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Total Organic Carbon (TOC)	16900	mg/kg(wet)	5	5	BaunG	4/28/97	9060 M

SAMPLE RESULTS

CLIENT SAMPLE ID: F103
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042085
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	213	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	179	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	8.29	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	43.8	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	111	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	0.30 J	mg/kg(wet)	0.1	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F103
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042085
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	CarmichaelJ	4/26/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1254)	0.50	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F103
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042065
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Aldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(alpha)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(gamma)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Dieldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan I	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan II	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan sulfate	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin aldehyde	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin ketone	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Heptachlor	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (alpha-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (beta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (delta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	808
Hexachlorocyclohexane (gamma-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Methoxychlor	nd	mg/kg(wet)	0.25	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDD	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDE	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDT	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Toxaphene	nd	mg/kg(wet)	2.5	0.2	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F104
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042086
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Total Organic Carbon (TOC)	17600	mg/kg(wet)	5	5	BaunG	4/28/97	9060 M

SAMPLE RESULTS

CLIENT SAMPLE ID: F104
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042086
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	276	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	228	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	16.3	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	27.2	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	124	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	0.55J	mg/kg(wet)	0.11	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID:	F104	**Report Date:**	5/22/97
Date Collected:	4/18/97	**EIS Sample No:**	042086
Date Received:	4/22/97	**EIS Order No:**	970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	CarmichaelJ	4/26/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1254)	0.52	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F104
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042086
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Aldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(alpha)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Chlordane(gamma)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Dieldrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan I	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan II	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endosulfan sulfate	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin aldehyde	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Endrin ketone	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Heptachlor	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (alpha-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (beta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (delta-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (gamma-BHC)	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Methoxychlor	nd	mg/kg(wet)	0.25	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDD	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDE	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDT	nd	mg/kg(wet)	0.05	0.005	CarmichaelJ	4/26/97	8081
Toxaphene	nd	mg/kg(wet)	2.5	0.2	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID:	F105	**Report Date:**	5/22/97
Date Collected:	4/18/97	**EIS Sample No:**	042087
Date Received:	4/22/97	**EIS Order No:**	970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	166	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	116	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	12.6	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	56.2	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	<0.12	mg/kg(wet)	0.12	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F105
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042087
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Acenaphthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Acenaphthylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(b)fluoranthene	0.63	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(ghi)perylene	0.52	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(k)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Chrysene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Dibenzo(a,h)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluoranthene	0.62	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluorene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Indeno(1,2,3-cd)pyrene	0.50	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Naphthalene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	827(
Phenanthrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 E
Pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B

SAMPLE RESULTS

CLIENT SAMPLE ID: F105
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042087
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	KlepperW	4/25/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F106
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042088
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	160	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	133	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	12.1	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	28.3	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	<0.13	mg/kg(wet)	0.13	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F106
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042088
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Acenaphthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Acenaphthylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(b)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(ghi)perylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(k)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Chrysene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Dibenzo(a,h)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluorene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Indeno(1,2,3-cd)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Naphthalene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Phenanthrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B

SAMPLE RESULTS

CLIENT SAMPLE ID: F106
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042088
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	KlepperW	4/25/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F107
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042089
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	144	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	137	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	10.4	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	28.2	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	<0.13	mg/kg(wet)	0.13	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F107
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042089
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Acenaphthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Acenaphthylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(a)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(b)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(ghi)perylene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Benzo(k)fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Chrysene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Dibenzo(a,h)anthracene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluoranthene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Fluorene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Indeno(1,2,3-cd)pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 P
Naphthalene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270
Phenanthrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B
Pyrene	nd	mg/kg(wet)	0.5	0.5	DavisW	4/24/97	8270 B

SAMPLE RESULTS

CLIENT SAMPLE ID: F107
Date Collected: 4/18/97
Data Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042089
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	CarmichaelJ	4/26/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F107
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042089
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Aldrin	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Chlordane(alpha)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Chlordane(gamma)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Dieldrin	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endosulfan I	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endosulfan II	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endosulfan sulfate	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endrin	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endrin aldehyde	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Endrin ketone	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Heptachlor	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (alpha-BHC)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (beta-BHC)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Hexachlorocyclohexane (delta-BHC)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	808
Hexachlorocyclohexane (gamma-BHC)	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Methoxychlor	nd	mg/kg(wet)	0.02	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDD	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDE	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
P,P'-DDT	nd	mg/kg(wet)	0.005	0.005	CarmichaelJ	4/26/97	8081
Toxaphene	nd	mg/kg(wet)	0.2	0.2	CarmichaelJ	4/26/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F108
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042090
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	199	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	138	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	14.9	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	45.7	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	0.12 J	mg/kg(wet)	0.11	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F108
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042090
EIS Order No: 970:00209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	KlepperW	4/25/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081

SAMPLE RESULTS

CLIENT SAMPLE ID: F109
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042091
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
Arsenic,Total	160	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Barium,Total	163	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Cadmium,Total	<1.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Chromium,Total	13.9	mg/kg(wet)	1	1	ClearN	4/28/97	6010
Lead,Total	50.2	mg/kg(wet)	5	5	ClearN	4/28/97	6010
Mercury,Total	0.11 J	mg/kg(wet)	0.11	0.2	ShaneD	4/30/97	7471
Selenium,Total	<5.0	mg/kg(wet)	5	5	ClearN	5/1/97	6010
Silver,Total	<2.0	mg/kg(wet)	1	1	ClearN	4/28/97	6010

SAMPLE RESULTS

CLIENT SAMPLE ID: F109
Date Collected: 4/18/97
Date Received: 4/22/97

Report Date: 5/22/97
EIS Sample No: 042091
EIS Order No: 970400209

Parameter	Results	Units	SDL	MDL	Analyst	Test Date	Method
PCB (AR1016)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1221)	nd	mg/kg(wet)	0.2	0.2	KlepperW	4/25/97	8081
PCB (AR1232)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1242)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1248)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1254)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081
PCB (AR1260)	nd	mg/kg(wet)	0.1	0.1	KlepperW	4/25/97	8081

ecology and environment, inc.
International Specialists in the Environment

33 North Dearborn Street
Chicago, Illinois 60602
Tel. 312/578-9243, Fax: 312/578-9345

MEMORANDUM

DATE: June 23, 1997

TO: Damon Sinars, START Project Manager, E & E, Chicago, Illinois

FROM: David Hendren, START Analytical Services Manager, E & E, Chicago, Illinois

THROUGH: Mary Jane Ripp, Assistant START Program Manager, E & E, Chicago, Illinois

SUBJECT: Data Quality Review for Polychlorinated Dibenzodioxin/Polychlorinated Dibenzofuran (PCDD/PCDF), Sauget Area One, Sauget, St. Clair County, Illinois

REFERENCE: Project TDD S05-9703-012 Analytical TDD S05-9704-806
Project PAN 7M1201SIXX Analytical PAN 7AAF01TAXX

The data quality assurance (QA) review of four sediment samples collected from the Sauget Area One site is complete. The samples were collected on April 18, 1997, by the Superfund Technical Assessment and Response Team (START) contractor, Ecology and Environment, Inc. (E & E). The samples were submitted to EIS Analytical Services, Inc., South Bend, Indiana. The laboratory analyses were performed according to the United States Environmental Protection Agency (U.S. EPA) Solid Waste 846 Method 8290.

Sample Identification

START Identification No.	Laboratory Identification No.
F301	42092
F302	42093
F305	42094
F307	42095

Data Qualifications:

I. Sample Holding Time: Acceptable

The samples were collected on April 18, 1997, extracted on April 27, 1997, and analyzed on May 5, 1997. This is within the six-month holding time limit, from collection to extraction and 40-day limit from extraction to analysis.

II. Gas Chromatography/Mass Spectrometry (GC/MS) Performance: Acceptable

Acceptable chromatographic resolution was demonstrated through the separation of 2,3,7,8-tetrachlorodibenzodioxin (TCDD) and 2,3,7,8-tetrachlorodibenzofuran (TCDF) isomers. The resolution of the mass spectrometer was verified before analysis.

III. Calibrations:

- Initial Calibration: Acceptable

A five-point initial calibration was performed prior to analysis. The percent relative standard deviations (%RSDs) between response factors were less than 20% for TCDD/TCDF.

- Continuing Calibration: Acceptable

The percent differences of the response factors were less than 15%, as required, for TCDD/TCDF.

IV. Blank: Acceptable

A method blank was analyzed with the samples. No target compounds or contaminants were detected in the blank.

V. Compound Identification: Acceptable

Identification of PCDD/PCDF present in the samples was based on numerous criteria, as specified in the method.

VI. Additional QC Checks: Acceptable

The recoveries of the internal standards added to each sample were within acceptable limits.

VII. Overall Assessment of Data for Use: Acceptable

The overall usefulness of the data is based on criteria for QA Level II as outlined in the Office of Solid Waste and Emergency Response (OSWER) Directive 9360.4-01 (April 1990), Data Validation Procedures, Section 8.0, 2,3,7,8-TCDD. Based upon the information provided, the data are acceptable for use.

TLI Project: **41521** Method 8290 PCDD/PCDF Analysis (

Client Sample: **F301** Analysis File: **S973012**

Client Project:	**Dioxins/Furans**				
Sample Matrix:	**SEDIMENT**	Date Received:	**04/23/97**	Spike File:	**SPX2372S**
TLI ID:	**165-74-1**	Date Extracted:	**04/27/97**	ICal:	**SF52067**
		Date Analyzed:	**05/05/97**	ConCal:	**S973006**
Sample Size:	**16.240 g**	Dilution Factor:	**n/a**	% Moisture:	**38.4**
Dry Weight:	**10.004 g**	Blank File:	**S972991**	% Lipid:	**n/a**
GC Column:	**DB-5**	Analyst:	**ADP**	% Solids:	**61.6**

Analyte	Conc. (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	ND	0.7				
1,2,3,7,8-PeCDD	EMPC		1.4			
1,2,3,4,7,8-HxCDD	4.1			1.07	27:38	
1,2,3,6,7,8-HxCDD	8.3			1.25	27:44	
1,2,3,7,8,9-HxCDD	7.9			1.11	28:01	
1,2,3,4,6,7,8-HpCDD	213			1.14	30:38	
1,2,3,4,6,7,8,9-OCDD	3250			0.80	33:02	
2,3,7,8-TCDF	3.5			0.69	17:56	
1,2,3,7,8-PeCDF	0.66			1.51	22:54	
2,3,4,7,8-PeCDF	1.1			1.40	23:46	
1,2,3,4,7,8-HxCDF	EMPC		9.2			E
1,2,3,6,7,8-HxCDF	1.8			1.26	26:57	
2,3,4,6,7,8-HxCDF	1.8			1.07	27:29	PR
1,2,3,7,8,9-HxCDF	ND	1.2				
1,2,3,4,6,7,8-HpCDF	210			0.90	29:45	
1,2,3,4,7,8,9-HpCDF	12.5			0.91	30:58	
1,2,3,4,6,7,8,9-OCDF	603			0.82	33:07	

Totals	Conc. (ppt)	Number	DL	EMPC	Flags
Total TCDD	58.5	8		62.8	
Total PeCDD	45.9	5		72.1	
Total HxCDD	92.6	6		113	
Total HpCDD	446	2			
Total TCDF	33.0	11		37.7	E
Total PeCDF	24.3	6		39.2	E
Total HxCDF	82.7	6		96.3	E
Total HpCDF	558	3			

X237_PSR v2.00, LARS 6.09.01

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 00:57 05/09/97

TLI Project: **41521**
Client Sample: **F301**

Method 8290 PCDD/PCDF Analysis (b)
Analysis File: **S973012**

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	155	77.[illegible]	40%-130%	0.76	17:55	—
$^{13}C_{12}$-2,3,7,8-TCDD	150	74.8	40%-130%	0.73	18:53	—
$^{13}C_{12}$-1,2,3,7,8-PeCDF	163	81.4	40%-130%	1.46	22:54	—
$^{13}C_{12}$-1,2,3,7,8-PeCDD	180	89.9	40%-130%	1.57	24:10	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	137	68.3	40%-130%	0.48	26:57	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	163	81.4	40%-130%	1.21	27:43	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	177	88.3	25%-130%	0.39	29:45	—
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	186	93.1	25%-130%	1.01	30:38	—
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	378	94.6	25%-130%	0.87	33:02	—

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	14.6	73.0	40%-130%		18:54	—
$^{13}C_{12}$-2,3,4,7,8-PeCDF	157	78.4	40%-130%	1.48	23:45	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	151	75.3	40%-130%	0.48	26:49	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	173	86.7	40%-130%	1.20	27:38	—
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	177	88.6	25%-130%	0.39	30:58	—

Alternate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	171	85.7	40%-130%	0.48	28:12	—
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	148	74.2	40%-130%	0.48	27:28	—

Recovery Standards	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.75	18:38	—
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.24	28:00	—

Data Reviewer: 3.A 05/09/97

X237_PSR v2.00, LARS 6.09.01

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 00:57 05/09/97

TLI Project: **41521r1** Method 8:)0 PCDD/PCDF Analysis

Client Sample: **F302** Analysis File: **T973246**

Client Project:	Dioxir /Furans				
Sample Matrix:	SEDI ENT	Date Received:	04/23/97	Spike File:	SPX2372S
TLI ID:	165-74-	Date Extracted:	05/06/97	ICal:	TF53286
		Date Analyzed:	05/10/97	ConCal:	T973236
Sample Size:	20.300	Dilution Factor:	n/a	% Moisture:	50.5
Dry Weight:	10.049 g	Blank File:	T973240	% Lipid:	n/a
GC Column:	DB-5	Analyst:	BB	% Solids:	49.5

Analytes	Conc (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	26.1			0.80	21:39	—
1,2,3,7,8-PeCDD	32.9			1.51	26:09	—
1,2,3,4,7,8-HxCDD	59.7			1.24	29:22	—
1,2,3,6,7,8-HxCDD	497			1.23	29:26	—
1,2,3,7,8,9-HxCDD	157			1.19	29:44	—
2,3,7,8-TCDF	176			0.81	20:53	—
1,2,3,7,8-PeCDF	27.9			1.68	25:03	PR_
2,3,4,7,8-PeCDF	63.0			1.54	25:48	—
1,2,3,4,7,8-HxCDF	EMPC		504			E_
1,2,3,6,7,8-HxCDF	86.3			1.28	28:44	—
2,3,4,6,7,8-HxCDF	178			1.23	29:12	—
1,2,3,7,8,9-HxCDF	7.1			1.24	29:57	—

Totals	Conc (ppt)	Number	DL	EMPC	Flags
Total TCDD	1820	8		1900	—
Total PeCDD	305	7		1500	—
Total HxCDD	3140	8		4380	—
Total TCDF	1630	16		1640	—
Total PeCDF	2210	14		2440	—
Total HxCDF	6320	8		6870	—

Internal Standards	Conc (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	149	75.0	40%-130%	0.75	20:50	—
$^{13}C_{12}$-2,3,7,8-TCDD	141	70.9	40%-130%	0.82	21:37	—
$^{13}C_{12}$-1,2,3,7,8-PeCDF	129	64.6	40%-130%	1.42	25:02	—
$^{13}C_{12}$-1,2,3,7,8-PeCDD	132	66.4	40%-130%	1.48	26:09	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	165	82.9	40%-130%	0.51	28:43	—
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	178	89.6	40%-130%	1.20	29:26	—

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 18:50 05/13/97

[illegible]

TLI Project: **41521r1**
Client Sample: F302

Method 8290 PCDD/PCDF Analysis (b)
Analysis File: **T973246**

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	16.5	83.0	40%-130%		21:39	—
$^{13}C_{12}$-2,3,4,7,8-PeCDF	141	71.0	40%-130%	1.51	25:47	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	181	90.8	40%-130%	0.48	28:37	—
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	178	89.3	40%-130%	1.21	29:21	—

Alternate [illegible]	Conc. [illegible]	% Recovery	[illegible]	Ratio	[illegible]	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	177	89.0	40%-130%	0.51	29:56	—
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	169	84.8	40%-130%	0.50	29:13	—

Reco[illegible]				Ratio	[illegible]	Flags
$^{13}C_{12}$-1,2,3,4-TCDD				0.81	21:26	—
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD				1.24	29:43	—

Data Reviewer: Stm 05/13/97

X237_PSR v2.00, LARS 6.09.01

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 18:50 05/13/97

TLI Project: **41521r1** Method 8290 PCDD/PCDF Analysis

Client Sample: **F305** Analysis File: **T973247**

Client Project:	**Dioxins/Furans**				
Sample Matrix:	**SEDIMENT**	Date Received:	**04/23/97**	Spike File:	**SPX2372S**
TLI ID:	**165-74-3**	Date Extracted:	**05/06/97**	ICal:	**TF53286**
		Date Analyzed:	**05/10/97**	ConCal:	**T973236**
Sample Size:	**15.830 g**	Dilution Factor:	**n/a**	% Moisture:	**36.9**
Dry Weight:	**9.989 g**	Blank File:	**T973240**	% Lipid:	**n/a**
GC Column:	**DB-5**	Analyst:	**BB**	% Solids:	**63.1**

Analytes	Conc (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	2.5			0.71	21:40	
1,2,3,7,8-PeCDD	EMPC		4.3			
1,2,3,4,7,8-HxCDD	9.3			1.23	29:23	
1,2,3,6,7,8-HxCDD	43.7			1.26	29:28	
1,2,3,7,8,9-HxCDD	19.3			1.22	29:45	
1,2,3,4,6,7,8-HpCDD	1350			1.05	32:16	
1,2,3,4,6,7,8,9-OCDD	11590			0.83	34:44	
2,3,7,8-TCDF	12.4			0.84	20:53	
1,2,3,7,8-PeCDF	3.0			1.52	25:04	PR
2,3,4,7,8-PeCDF	5.5			1.53	25:49	
1,2,3,4,7,8-HxCDF	EMPC		41.0			E
1,2,3,6,7,8-HxCDF	11.8			1.24	28:45	
2,3,4,6,7,8-HxCDF	14.0			1.30	29:15	PR
1,2,3,7,8,9-HxCDF	0.96			1.05	29:58	PR
1,2,3,4,6,7,8-HpCDF	609			1.05	31:25	
1,2,3,4,7,8,9-HpCDF	45.3			1.09	32:36	
1,2,3,4,6,7,8,9-OCDF	5190			0.90	34:51	

Totals	Conc (ppt)	Number	DL	EMPC	Flags
Total TCDD	73.5	9		84.4	
Total PeCDD	45.8	5		160	
Total HxCDD	289	7		436	
Total HpCDD	2490	2			
Total TCDF	129	15		132	
Total PeCDF	219	10		266	E
Total HxCDF	582	8		631	
Total HpCDF	2720	3			

X237_PSR v2.00, LARS 6.09.01

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 18:52 05/13/97

TLI Project: 41521r1 | Method 8290 PCDD/PCDF Analysis (b)
Client Sample: F305 | Analysis File: T973247

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	117	58.2	40%-130%	0.76	20:52	___
$^{13}C_{12}$-2,3,7,8-TCDD	101	50.6	40%-130%	0.83	21:39	___
$^{13}C_{12}$-1,2,3,7,8-PeCDF	95.8	47.9	40%-130%	1.50	25:04	___
$^{13}C_{12}$-1,2,3,7,8-PeCDD	99.4	49.7	40%-130%	1.48	26:10	___
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	128	63.9	40%-130%	0.52	28:44	___
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	140	69.9	40%-130%	1.21	29:27	___
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	132	66.0	25%-130%	0.44	31:24	___
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	125	62.3	25%-130%	1.00	32:15	___
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	233	58.1	25%-130%	0.87	34:44	___

Surrogate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	10.4	52.2	40%-130%		21:40	___
$^{13}C_{12}$-2,3,4,7,8-PeCDF	99.4	49.7	40%-130%	1.49	25:49	___
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	130	65.0	40%-130%	0.50	28:39	___
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	138	68.9	40%-130%	1.22	29:22	___
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	140	69.7	25%-130%	0.43	32:36	___

Alternate Standards (Type B)	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	144	72.1	40%-130%	0.52	29:57	___
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	130	65.1	40%-130%	0.51	29:15	___

Recovery Standards	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD	0.81	21:27	___
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD	1.24	29:45	___

Data Reviewer: ______________________ 05/13/97

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 18:52 05/13/97

TRIANGLE LABORATORIES

TLI Project: 41521
Client Sample: F307

Method 8290 PCDD/PCDF Analysis (b)
Analysis File: S973015

Client Project:	Dioxins/Furans				
Sample Matrix:	SEDIMENT	Date Received:	04/23/97	Spike File:	SPX2372S
TLI ID:	165-74-4	Date Extracted:	04/27/97	ICal:	SF52067
		Date Analyzed:	05/05/97	ConCal:	S973006
Sample Size:	14.430 g	Dilution Factor:	n/a	% Moisture:	30.8
Dry Weight:	9.986 g	Blank File:	S972991	% Lipid:	n/a
GC Column:	DB-5	Analyst:	ADP	% Solids:	69.2

Analytes	Conc. (ppt)	DL	EMPC	Ratio	RT	Flags
2,3,7,8-TCDD	ND	0.6				—
1,2,3,7,8-PeCDD	ND	0.8				—
1,2,3,4,7,8-HxCDD	ND	1.4				—
1,2,3,6,7,8-HxCDD	EMPC		3.3			—
1,2,3,7,8,9-HxCDD	3.0			1.26	28:02	—
1,2,3,4,6,7,8-HpCDD	53.0			0.99	30:38	—
1,2,3,4,6,7,8,9-OCDD	599			0.81	33:03	—
2,3,7,8-TCDF	3.4			0.80	17:56	—
1,2,3,7,8-PeCDF	ND	0.6				—
2,3,4,7,8-PeCDF	EMPC		1.2			—
1,2,3,4,7,8-HxCDF	EMPC		4.5			E
1,2,3,6,7,8-HxCDF	1.2			1.20	26:58	—
2,3,4,6,7,8-HxCDF	1.4			1.09	27:29	—
1,2,3,7,8,9-HxCDF	ND	1.0				—
1,2,3,4,6,7,8-HpCDF	21.2			0.96	29:46	—
1,2,3,4,7,8,9-HpCDF	ND	1.3				—
1,2,3,4,6,7,8,9-OCDF	49.8			0.84	33:07	—

Totals	Conc. (ppt)	Number	DL	EMPC	Flags
Total TCDD	17.1	5		25.0	—
Total PeCDD	21.8	5		28.9	—
Total HxCDD	19.2	3		36.9	—
Total HpCDD	105	2			—
Total TCDF	18.7	9		25.4	E
Total PeCDF	8.8	2		31.8	E
Total HxCDF	18.4	4		25.6	E
Total HpCDF	55.7	2			—

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713

LI Project: **41521**
Client Sample: **F307**

Method 8290 PCDD/PCDF Analysis (b)
Analysis File: **S973015**

Internal Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-2,3,7,8-TCDF	84.9	42.4	40%-130%	0.75	17:56	
$^{13}C_{12}$-2,3,7,8-TCDD	77.5	38.7	40%-130%	0.83	18:54	V
$^{13}C_{12}$-1,2,3,7,8-PeCDF	79.2	39.5	40%-130%	1.45	22:54	V
$^{13}C_{12}$-1,2,3,7,8-PeCDD	98.4	49.2	40%-130%	1.46	24:11	
$^{13}C_{12}$-1,2,3,6,7,8-HxCDF	78.3	39.1	40%-130%	0.48	26:57	V
$^{13}C_{12}$-1,2,3,6,7,8-HxCDD	85.9	42.9	40%-130%	1.22	27:43	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDF	80.3	40.1	25%-130%	0.42	29:45	
$^{13}C_{12}$-1,2,3,4,6,7,8-HpCDD	102	51.1	25%-130%	0.97	30:38	
$^{13}C_{12}$-1,2,3,4,6,7,8,9-OCDD	214	53.5	25%-130%	0.82	33:02	

Surrogate Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{37}Cl_4$-2,3,7,8-TCDD	6.9	34.6	40%-130%		18:55	V
$^{13}C_{12}$-2,3,4,7,8-PeCDF	84.8	42.4	40%-130%	1.43	23:45	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDF	85.8	42.8	40%-130%	0.49	26:50	
$^{13}C_{12}$-1,2,3,4,7,8-HxCDD	85.8	42.9	40%-130%	1.20	27:38	
$^{13}C_{12}$-1,2,3,4,7,8,9-HpCDF	89.2	44.5	25%-130%	0.39	30:58	

Alternate Standards	Conc. (ppt)	% Recovery	QC Limits	Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,7,8,9-HxCDF	89.4	44.6	40%-130%	0.48	28:12	
$^{13}C_{12}$-2,3,4,6,7,8-HxCDF	83.7	41.8	40%-130%	0.49	27:29	

Recovery Standards				Ratio	RT	Flags
$^{13}C_{12}$-1,2,3,4-TCDD				0.84	18:38	
$^{13}C_{12}$-1,2,3,7,8,9-HxCDD				1.21	28:01	

Data Reviewer: S.A. 05/09/97

X237_PSR v2.00, LARS 6.09.01

Triangle Laboratories, Inc.
801 Capitola Drive • Durham, North Carolina 27713
Phone: (919) 544-5729 • Fax: (919) 544-5491

Printed: 01:40 05/09/97

Appendix B

Existing Domestic Well Water Quality Data

SAUGET Analytical Data
Site Area 1 Private Wells

GROUND WATER SAMPLES
Volatile Organic Compounds ($\mu g/L$)
Collected by Ecology & Environment, Inc. (3/87)

	Sample Number	DC-GW-52	DC-GW-53	DC-GW-54	DC-GW-55	Maximum
	Well Number	WRIGHT	SETTLES	SCHMIDT	McDONALD	Concentration
	Date Collected	03/26/87	03/26/87	03/26/87	03/26/87	Detected
VOC						
Chloromethane		ND	ND	ND	ND	ND
Bromomethane		ND	ND	ND	ND	ND
Vinyl chloride		ND	ND	ND	ND	ND
Chloroethane		ND	ND	ND	ND	ND
Methylene chloride		4 BJ	12 B	ND	37 B	37 B
Acetone		18 B	10 B	8 BJ	9 BJ	18 B
Carbon Disulfide		ND	3 J	ND	ND	3 J
1,1-Dichloroethene		ND	ND	ND	ND	ND
1,1-Dichloroethane		ND	ND	ND	ND	ND
trans-1,2-Dichloroethene		ND	ND	ND	ND	ND
Chloroform		ND	2 J	ND	ND	2 J
1,2-Dichloroethane		ND	ND	ND	ND	ND
2-Butanone (MEK)		ND	ND	ND	ND	ND
1,1,1-Trichloroethane		ND	ND	ND	ND	ND
Carbon Tetrachloride		ND	ND	ND	ND	ND
Vinyl Acetate		ND	ND	ND	ND	ND
Bromodichloromethane		ND	ND	ND	ND	ND
1,2-Dichloropropane		ND	ND	ND	ND	ND
trans-1,3-Dichloropropene		ND	ND	ND	ND	ND
Trichloroethene		ND	ND	ND	ND	ND
Dibromochloromethane		ND	ND	ND	ND	ND
1,1,2-Trichloroethane		ND	ND	ND	ND	ND
Benzene		ND	ND	ND	ND	ND
cis-1,3-Dichloropropene		ND	ND	ND	ND	ND
2-Chloroethyl Vinyl Ether		ND	ND	ND	ND	ND
Bromoform		ND	ND	ND	ND	ND
4-Methyl-2-pentanone		ND	ND	ND	ND	ND
2-Hexanone		ND	ND	ND	ND	ND
Tetrachloroethene		ND	ND	ND	ND	ND
1,1,2,2-Tetrachloroethane		ND	ND	ND	ND	ND
Toluene		1 BJ	1 BJ	ND	1 BJ	1 BJ
Chlorobenzene		ND	ND	ND	ND	ND
Ethylbenzene		4 J	ND	ND	ND	4 J
Styrene		ND	2 J	ND	2 J	2 J
Total Xylenes		ND	ND	ND	ND	ND

$\mu g/L$ - Micrograms per liter
B - Compound also detected in blank
J - Estimated value
ND - Not detected

SAUGET Analytical Data
Site Area 1 Private Wells

GROUND WATER SAMPLES
Base Neutrals/Acids ($\mu g/L$)
Collected by Ecology & Environment, Inc. (3/87)

	Sample Number	DC-GW-52	DC-GW-53	DC-GW-54	DC-GW-55	Maximum
	Well Number	WRIGHT	SETTLES	SCHMIDT	McDONALD	Concentration
	Date Collected	03/26/87	03/26/87	03/26/87	03/26/87	Detected
BNAs						
Phenol		ND	ND	ND	ND	ND
bis(2-Chloroethyl)ether		ND	ND	ND	ND	ND
2-Chlorophenol		ND	ND	ND	ND	ND
1,3-Dichlorobenzene		ND	ND	ND	ND	ND
1,4-Dichlorobenzene		ND	ND	ND	ND	ND
Benzyl Alcohol		ND	ND	ND	ND	ND
1,2-Dichlorobenzene		ND	ND	ND	ND	ND
2-Methylphenol		ND	ND	ND	ND	ND
bis(2-Chloroisopropyl)ether		ND	ND	ND	ND	ND
4-Methylphenol		ND	ND	ND	ND	ND
N-Nitroso-n-Dipropylamine		ND	ND	ND	ND	ND
Hexachloroethane		ND	ND	ND	ND	ND
Nitrobenzene		ND	ND	ND	ND	ND
Isophorone		ND	ND	ND	ND	ND
2-Nitrophenol		ND	ND	ND	ND	ND
2,4-Dichlorophenol		ND	ND	ND	ND	ND
Benzoic Acid		ND	ND	ND	ND	ND
bis-(2-Chloroethoxy)methane		ND	ND	ND	ND	ND
2,4-Dichlorophenol		ND	ND	ND	ND	ND
1,2,4-Trichlorophenol		ND	ND	ND	ND	ND
Naphthalene		ND	ND	ND	ND	ND
4-Chloroaniline		ND	ND	ND	ND	ND
Hexachlorobutadiene		ND	ND	ND	ND	ND
4-Chloro-3-methylphenol		ND	ND	ND	ND	ND
2-Methylnaphathalene		ND	ND	ND	ND	ND
Hexachlorocyclopentadiene		ND	ND	ND	ND	ND
2,4,6-Trichlorophenol		ND	ND	ND	ND	ND
2,4,5-Trichlorophenol		ND	ND	ND	ND	ND
2-Chloronaphthalene		ND	ND	ND	ND	ND
2-Nitroaniline		ND	ND	ND	ND	ND
Dimethyl Phthalate		ND	ND	ND	ND	ND
Acenaphthylene		ND	ND	ND	ND	ND
3-Nitroaniline		ND	ND	ND	ND	ND
Acenaphthene		ND	ND	ND	ND	ND

$\mu g/L$ - Micrograms per liter
J - Estimated value
ND - Not detected

SAUGET Analytical Data
Site Area 1 Private Wells

GROUND WATER SAMPLES
Base Neutrals/Acids (μg/L)
Collected by Ecology & Environment, Inc. (3/87)

recycled paper

	Sample Number	DC-GW-52	DC-GW-53	DC-GW-54	DC-GW-55	Maximum
	Well Number	WRIGHT	SETTLES	SCHMIDT	McDONALD	Concentration
	Date Collected	03/26/87	03/26/87	03/26/87	03/26/87	Detected
BNAs						
2,4-Dinitrophenol		ND	ND	ND	ND	ND
4-Nitrophenol		ND	ND	ND	ND	ND
Dibenzofuran		ND	ND	ND	ND	ND
2,4-Dinitrotoluene		ND	ND	ND	ND	ND
2,6-Dinitrotoluene		ND	ND	ND	ND	ND
Diethylphthalate		ND	ND	ND	ND	ND
4-Chlorophenyl-Phenylether		ND	ND	ND	ND	ND
Fluorene		ND	ND	ND	ND	ND
4-Nitroaniline		ND	ND	ND	ND	ND
4,6-Dinitro-2-methylphenol		ND	ND	ND	ND	ND
N-Nitrosodiphenylamine		ND	ND	ND	ND	ND
4-Bromophenyl-phenylether		ND	ND	ND	ND	ND
Hexachlorobenzene		ND	ND	ND	ND	ND
Pentachlorophenol		ND	ND	ND	ND	ND
Phenanthrene		ND	ND	ND	ND	ND
Anthracene		ND	ND	ND	ND	ND
Di-n-butly phthalate		ND	ND	ND	ND	ND
Fluoranthene		ND	ND	ND	ND	ND
Pyrene		ND	ND	ND	ND	ND
Butyl Benzyl phthalate		ND	ND	ND	ND	ND
3,3'-Dichlorobenzidine		ND	ND	ND	ND	ND
Benzo (a)anthracene		ND	ND	ND	ND	ND
bis(2-ethylhexyl)phthalate		ND	ND	ND	ND	ND
Chrysene		ND	ND	ND	ND	ND
Di-n-octyl phthalate		2 J	ND	2 J	4 J	4 J
Benzo(b)fluoranthene		ND	ND	ND	ND	ND
Benzo(k)fluoranthene		ND	ND	ND	ND	ND
Benzo (a)pyrene		ND	ND	ND	ND	ND
Indeno(1,2,3-cd)pyrene		ND	ND	ND	ND	ND
Benzo(g,h,i)perylene		ND	ND	ND	ND	ND
Dibenzo(a,h)anthracene		ND	ND	ND	ND	ND

μg/L - Micrograms per liter
J - Estimated value
ND - Not detected

SAUGET Analytical Data
Site Area 1 Private Wells

GROUND WATER SAMPLES
Pesticides/PCBs ($\mu g/L$)
Collected by Ecology & Environment, Inc. (3/87)

	Sample Number	DC-GW-52	DC-GW-53	DC-GW-54	DC-GW-55	Maximum
	Well Number	WRIGHT	SETTLES	SCHMIDT	McDONALD	Concentration
	Date Collected	03/26/87	03/26/87	03/26/87	03/26/87	Detected
Pesticides/PCBs						
Alpha-BHC		ND	ND	ND	ND	ND
Beta-BHC		ND	ND	ND	ND	ND
Delta-BHC		ND	ND	ND	ND	ND
Gamma-BHC (Lindane)		ND	ND	ND	ND	ND
Heptachlor		ND	ND	ND	ND	ND
Aldrin		ND	ND	ND	ND	ND
Heptachlor Epoxide		ND	ND	ND	ND	ND
Endosulfan I		ND	ND	ND	ND	ND
Dieldrin		ND	ND	ND	ND	ND
4,4'-DDE		ND	ND	ND	ND	ND
Endrin		ND	ND	ND	ND	ND
Endosulfan II		ND	ND	ND	ND	ND
4,4'-DDD		ND	ND	ND	ND	ND
Endosulfan sulfate		ND	ND	ND	ND	ND
4,4'-DDT		ND	ND	ND	ND	ND
Methoxychlor		ND	ND	ND	ND	ND
Endrin Ketone		ND	ND	ND	ND	ND
Chlordane		ND	ND	ND	ND	ND
Toxaphene		ND	ND	ND	ND	ND
Aroclor-1016		ND	ND	ND	ND	ND
Aroclor-1221		ND	ND	ND	ND	ND
Aroclor-1232		ND	ND	ND	ND	ND
Aroclor-1242		ND	ND	ND	ND	ND
Aroclor-1248		ND	ND	ND	ND	ND
Aroclor-1254		ND	ND	ND	ND	ND
Aroclor-1260		ND	ND	ND	ND	ND

µg/L - Micrograms per liter
ND - Not detected

recycled paper

SAUGET Analytical Data
Site Area 1 Private Wells

GROUND WATER SAMPLES
Total Metals (µg/L)
Collected by Ecology & Environment, Inc. (3/87)

	Sample Number	[redacted]	DC-GW-52	DC-GW-53	DC-GW-54	DC-GW-55	**Maximum**
	Well Number		WRIGHT	SETTLES	SCHMIDT	McDONALD	**Concentration**
	Date Collected		03/26/87	03/26/87	03/26/87	03/26/87	**Detected**
Total Metals							
Aluminum			ND	ND	ND	ND	ND
Antimony			ND	ND	ND	ND	ND
Arsenic			ND	ND	**11**	**26**	**26**
Barium			**[73]**	**[89]**	**292**	**[117]**	**117**
Beryllium			ND	ND	ND	ND	ND
Boron			ND	ND	ND	ND	ND
Cadmium			ND	ND	ND	ND	ND
Chromium			ND	ND	ND	ND	ND
Cobalt			ND	ND	ND	ND	ND
Copper			ND	**[10]**	**115**	ND	**115**
Iron			**2990**	**4600**	**21600**	**10600**	**21600**
Lead			ND	**12 R**	**18 R**	ND	**18 R**
Manganese			**1060**	**665**	**1660**	**257**	**1660**
Mercury			ND	ND	**0.2**	ND	**0.2**
Nickel			ND	ND	ND	ND	ND
Selenium			ND	ND	ND	ND	ND
Silver			ND	ND	ND	ND	ND
Thallium			ND	ND	ND	ND	ND
Tin			ND	ND	ND	ND	ND
Vanadium			ND	ND	ND	ND	ND
Zinc			**4140 R**	**2000 R**	**377 R**	**1350 R**	**4140 R**
Cyanide			ND	ND	ND	ND	ND

µg/L - Micrograms per liter
ND - Not detected
R - Spike sample recovery not within control limits

SAUGET Analytical Data
Area 1- Groundwater Monitoring Survey

GROUNDWATER SAMPLES
Organics (μg/L)
Collected by IEPA

	Sample Number	S01	S02	S03	S04	S05	S06	R09	Maximum
	Date Collected	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	Concentration
Organics								Blank	
bis (2ethylhexyl)phthalate		64	62			19	**		64
di-n-butylphthalate		**	**	**	**		**		ND
diethylphthalate		**	**	**	**			**	ND
3,4-benzofluoranthene*		**							ND
Benzo(k)fluoranthene*		**							ND
Methylene Chloride		16	16	2300	3100	990	2000	19	3100
di-n-octylphthalate			X	X					ND
1,2-dichlorobenzene					**				ND
1,4-dichlorobenzene					**				ND
butyl benzyl phthalate					**			**	ND
Chlorobenzene					**	**			ND
heptachlor					0.11 ***	0.14 ***			0.14 ***
beta-BHC					0.18 ***	0.3 ***	4.04 ***		4.04 ***
gamma-BHC					0.16 ***	0.25 ***			0.25 ***
aldrin					0.17 ***				0.17 ***
alpha-BHC						0.18 ***	0.25 ***		0.25 ***
4,4-DDE							0.11 ***		0.11 ***
heptachlor epoxide							1.46 ***		1.46 ***
delta-BHC							0.95 ***		0.95 ***

µg/L - Micrograms per liter.
ND - Not detected
* Coelute
** Less than 10 mg/l
*** Not confirmed by GCMS
X Results unacceptable due to bad spike recovery of blind sample

SAUGET Analytical Data
Area 1- Groundwater Monitoring Survey

GROUNDWATER SAMPLES
Metals ($\mu g/L$)
Collected by IEPA

	Sample Number	S01	S02	S03	S04	S05	S06	R09	Maximun
	Date Collected	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	3/3/82	Detected
Total Metals								Blank	
Total Aluminum		<200	410	390	<200	940	1200	<200	1200
Arsenic		11	<10	<10	29	<10	<10	<10	29
Barium		<100	<100	<100	<100	<100	<100	<100	ND
Boron		10500	11000	8000	1800	140	110	<100	11000
Cadmium		4.2	14	31	5.3	<1	2.8	<1	31
Chromium		12	<10	<10	<10	<10	<10	<10	12
Cobalt		62	70	82	95	<50	<50	<50	95
Copper		65	<50	<50	<50	<50	<50	<50	65
Iron		65000	31000	38000	28000	530	250	<50	65000
Lead		570	97	74	9	11	10	<5	570
Manganese		1600	1100	1500	5100	460	80	<15	5100
Mercury*		<0.2	<0,2	<0,2	<0,2	<0.2	<0.2	<0 2	ND
Nickel		<40	<40	<40	140	<40	<40	<40	140
Selenium		<2	<2	<2	<2	<2	<2	<2	ND
Silver		<10	<10	<10	<10	<10	<10	<10	ND
Tin		<20	<20	<20	<20	<20	<20	<20	ND
Vanadium		<200	<200	<200	<200	<200	<200	<200	ND
Zinc		107000	109000	40000	1900	260	350	<10	109000
Antimony		<20	<20	<20	<20	<20	<20	<20	ND
Thallium		<10	<10	<10	<10	<10	<10	<10	ND
Beryllium		<5	<5	<5	<5	<5	<5	<5	ND
Mercury**		0.1	0.4	0.4	0.2	0.1	<0.1	<0.1	0.4

µg/L - Micrograms per liter.
ND - Not detected.
* Cal Analytical Labs Test
** CRL Lab Test

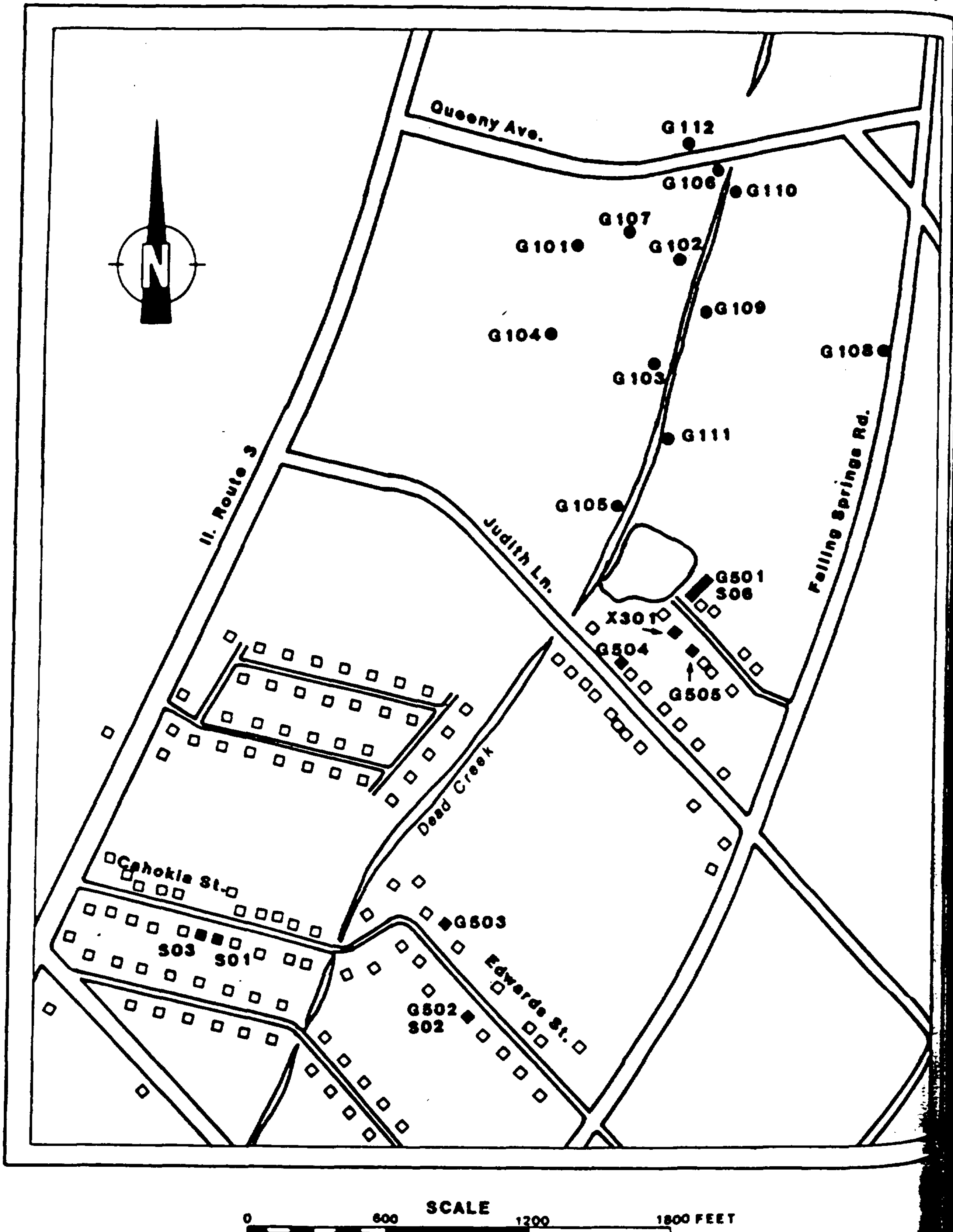


FIGURE B-2
LOCATIONS OF IEPA MONITORING WELLS AND RESIDENTIAL WELLS SAMPLED IN THE VICINITY OF DEAD CREEK

SAUGET Analytical Data
Sauget Sites Area I

MONITORING WELL SAMPLES
Total Metals (mg/l)
Collected by IEPA

	Sample Number	G501	G502	G503	G504	G505	X301	Maximum
	Date Collected	9/16/80	9/16/80	9/16/80	9/23/80	6/8/83	1/5/83	Concentration
Metals								Detected
Arsenic		0.008	0.004	0.001	ND	0.01	0.017	0.017
Barium		0.2	0.16	0.39	0.05	0.4	1.1	1.1
Boron		0.28	0.27	0.25	0.58	0.4	0.3	0.58
Cadmium		ND	ND	ND	ND	ND	ND	ND
Chromium Total		ND	ND	ND	ND	ND	ND	ND
Copper		0.02	ND	ND	0.06	0.01	0.08	0.08
Iron		4.6	19	17.7	0.73	26	31	31
Lead		ND	ND	ND	ND	ND	0.08	0.08
Magnesium		33	39	36	30	35.3	54	54
Manganese		1.02	1.26	0.79	0.65	1.3	1.49	1.49
Mercury		ND	ND	ND	0.0001	ND	ND	0.0001
Nickel		ND	ND	ND	0.02	ND	0.1	0.1
Phosphorus		ND	ND	ND	0.02	0.62	1.2	1.2
Potassium		6.6	5.7	4.5	6	6.2	6.4	6.6
Silver		ND	ND	ND	ND	ND	ND	ND
Sodium		21	24	12	26	15.2	19	26
Zinc		0.85	ND	0.18	0.8	ND	0.7	0.85

mg/kg - Milligrams per kilogram.

ND - Not detected

Sample X301 was collected from basement seepage

SAUGET Analytical Data
Sauget Sites Area 1

MONITORING WELL SAMPLES
Pesticides/PCBs (mg/l)
Collected by IEPA

	Sample Number	G501	G502	G503	G504	G505	X301	**Maximum**
	Date Collected	9/16/80	9/16/80	9/16/80	9/23/80	6/8/83	1/5/83	**Concentration**
Pesticides/PCBs								**Detected**
PCBs		NA	NA	NA	ND	ND	ND	ND
Chlordane (ppb)		NA	NA	NA	NA	ND	**0.13**	**0.13**

mg/kg - Milligrams per kilogram.
NA - Parameter not analyzed
ND - Not detected.
ppb - Parts per billion
Sample X301 was collected from basement seepage

SAUGET Analytical Data

Sauget Sites Area 1

GROUNDWATER SAMPLES ($\mu g/L$)

Collected by IEPA

	Sample Number	G204	G201	G205	Maximum
	Well Number	H KEARBY	B SETTLE	W ALLEN	Concentration
	Date Collected	3/91	3/91	3/91	Detected
VOLATILES					
Chlorobenzene		ND	ND	ND	ND
SEMIVOLATILES					
Pyrene		ND	ND	ND	ND
Benzo(b)fluoranthene		ND	ND	ND	ND
Chrysene		ND	ND	ND	ND
PESTICIDES/PCB's					
4,4'-DDE		ND	ND	ND	ND
Endrin		ND	ND	ND	ND
Endosulfan II		ND	ND	ND	ND
Gamma-Chlorodane		ND	ND	5.02	5.02
Aroclor-1254		ND	ND	ND	ND
Aroclor-1260		ND	ND	ND	ND
INORGANICS					
Arsenic		ND	ND	ND	ND
Barium		ND	ND	ND	ND
Cadmium		ND	ND	ND	ND
Calcium		ND	ND	11900	11900
Chromium		ND	ND	ND	ND
Cobalt		ND	6.2	ND	6.2
Copper		ND	ND	75	75
Lead		3.3	ND	11	11
Magnesium		ND	ND	ND	ND
Mercury		ND	ND	ND	ND
Nickel		ND	ND	ND	ND
Zinc		38	580	658	658

$\mu g/L$ - Micrograms per liter
ND - Not detected

Filename AREA1I~1 XLS - Table more Water IEPA

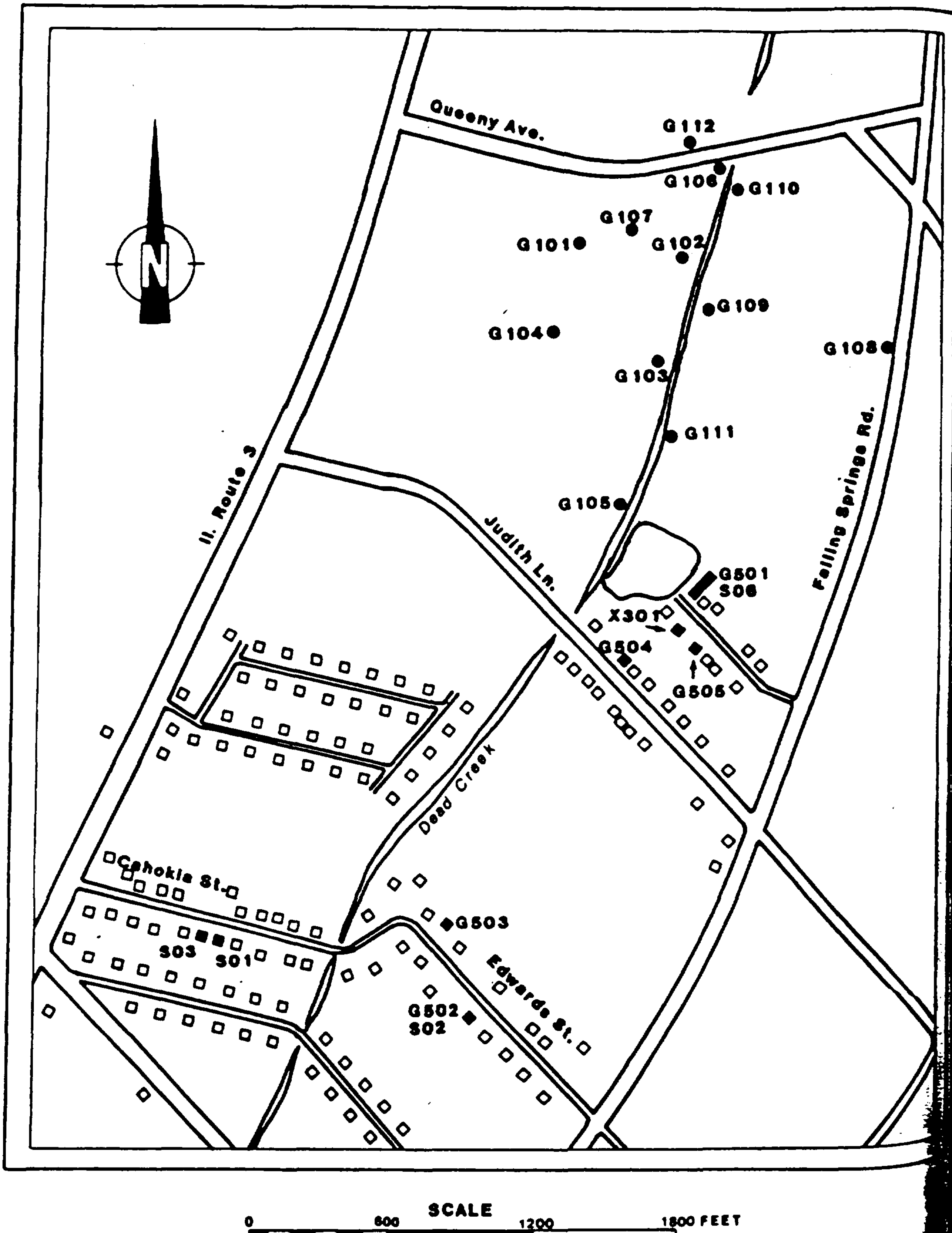


FIGURE B-2
LOCATIONS OF IEPA MONITORING WELLS AND RESIDENTIAL
WELLS SAMPLED IN THE VICINITY OF DEAD CREEK

ANALYSIS OF GROUNDWATER SAMPLES FROM THE IEPA MONITORING WELLS
(COLLECTED 10-23-80)

SAUGET Analytical Data
Dead Creek - Segment B

WATER SAMPLES

Collected by IEPA and Monsanto Chemical Co. (10/80)

	Sample Number	0100307				Maximum
	Date Collected	10/2/80				Concentration
	Location	Well at Threasa's				Detected
PCBs and Elemental Phosphorus (µg/L)		Greenhouse 101 Walnut				
PCB's (Cl_2 to Cl_6 Homologs)		ND<1				ND
P_4		NA				NA

µg/L - Micrograms per liter

NA - Not Analyzed

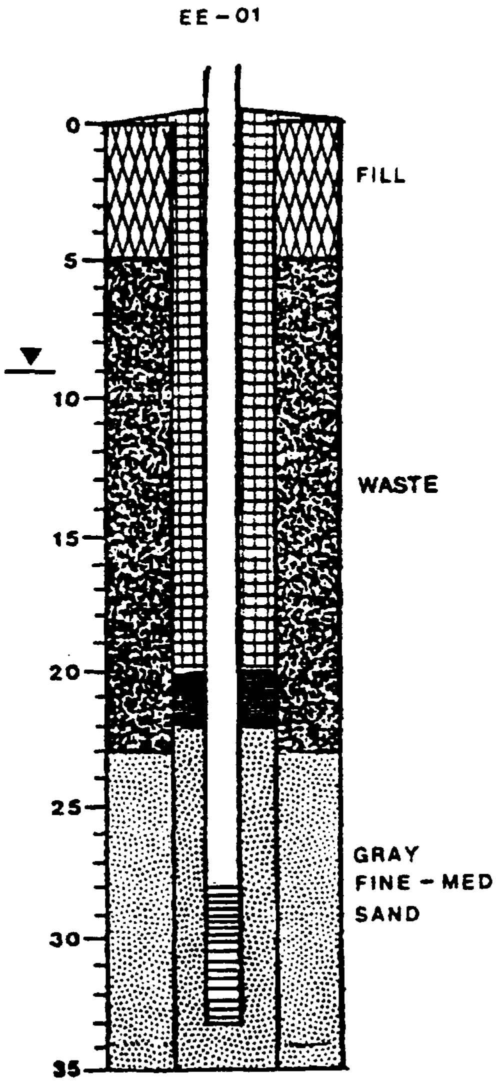
ND - Not detected

Appendix C

Existing Well Logs

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-6-87
Prepared by Kevin Phillips

Depth (ft) Description



Boring/Well No. H-2/EE-01
Location Site H
Owner IEPA
Top of Inner Casing Elev. 408.84
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/5/87,1/6/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers, Rotary

WELL DATA

Hole Diam. 8 in.
Boring Depth 35.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 28 - 33 ft.
Screen Type stainless steel 0.01" slot
Stickup 2.3 ft.
Well Type monitoring
Well Construction:
Filter Pack 33 - 22 ft.
Seal 22 - 20 ft.
Grout 10 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.41 Date 3-26-87
Static Water Elev. 398.55 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other ph = 6.8
Cond. = 2600 umhos Temp. = 56° F
Yellow-brown color, turbid

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples Groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes ___ No X
Recipient

Comments Subsurface soil sample from boring 5 - 20' analyzed for HSL compounds.

REMARKS

Strong organic odor

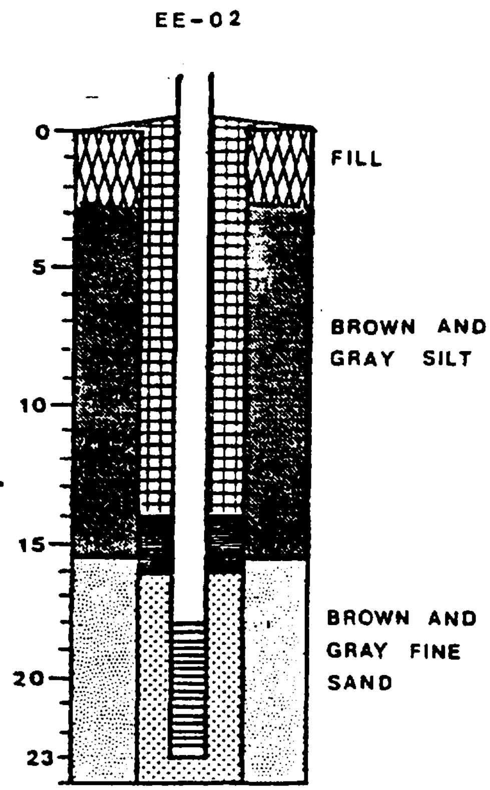
MCO 6565882

Site Dead Creek Site-H Boring/Well No. H-2/well # EE-01

Sample Depth	Blow Count	Description
1 - 2.5	3-3-4	0-1.5 FILL consisting of black cinders and small gravel. (dry) 1.5-2.5 FILL consisting of brownish cinders, slag, and medium grain sand. (dry)
3.5 - 5	2-3-3	3.5-4 FILL - same as above. 4-5 FILL consisting of dark gray SILT. Soft and stained. Little of fine grain sand. (very moist)
6 - 7.5	35-17-19	WASTE steel and a coal-like dense black flaky substance.
8.5 - 10	2-3-3	WASTE - Wood and paper products, heavy black staining.
11 - 12.5	3-3-5	WASTE - same as above.
13.5 - 15	2-3-5	WASTE consisting of black (stained) silt, medium grain sand and wood. (wet)
16 - 17.5	4-8-9	WASTE - Wood chips.
18.5 - 20	5-7-14	WASTE - same as above.
21 - 22.5	9-10-13	WASTE - same as above.
		WASTE discontinues @ approx. 23'.
23.5 - 25	2-1-6	Firm brownish-gray fine-medium grain SAND. Black staining throughout. Well-rounded and well sorted. Rounded to subangular. (wet)
33.5 - 35	9-10-12	Dense gray fine-medium grain SAND. Trace of coarse grain sand. Fairly well sorted and rounded to subangular. (wet)
		E.O.B. @ 35

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-6-87
Prepared by Kevin Phillips

Depth (ft) Description



Boring/Well No. H-3/EE-02
Location Site H
Owner IEPA
Top of Inner Casing Elev. 409.91
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/6/87,1/6/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 23.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 2.25 ft.
Well Type monitoring
Well Construction:
- Filter Pack 23 - 16 ft.
- Seal 16 - 14 ft.
- Grout 14 ft. to surface
- Lock No. 2834

TEST DATA

Static Water Elev. 397.58 Date 3-26-87
Static Water Elev. 398.61 Date 5-11-87
Slug Test Yes___ No X
Test Date
Hydraulic Conductivity
Other pH = 4.0
Cond. = 4200 umhos Temp. = 54 F
Yellowish

WATER QUALITY

Samples Taken Yes X No___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes___ No X
Recipient

Comments Subsurface soil samples from boring 10 - 20' analyzed for HSL compounds.

REMARKS

Slight organic odor

MCO 6565884

Site Dead Creek Site-H | Boring/Well No. H-3/well #EE-02

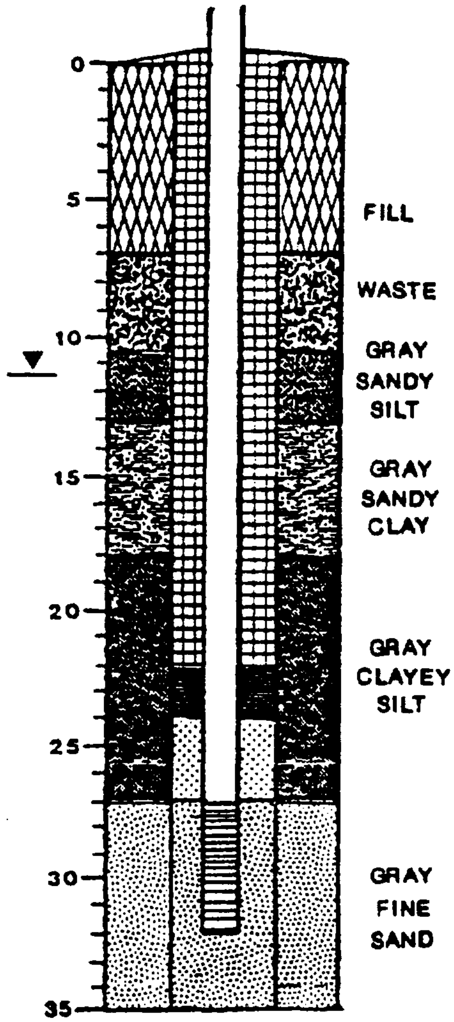
Sample Depth	Blow Count	Description
1 - 2.5	6-10-13	0-2.5 FILL consisting of dense brown sandy CLAY including small gravel, cinders, and brick fragments.
3.5 - 5	2-3-4	Firm brown SILT and silty CLAY. Trace of fine grain sand. (moist).
6 - 7.5	2-4-6	Firm brown to yellowish brown very sandy SILT. Some fine grain sand and trace of silty clay. (moist)
8.5 - 10	2-2-2	Same as above. (very moist)
11 - 12.5	5-11-14	Dense brownish-gray silt and fine grain SAND. (wet)
13.5 - 15	7-7-7	Same as above.
		Water table @ approx. 13 feet.
16 - 17.5	9-10-20	Very dense gray very silty fine grain SAND. Some silt. Wet.
18.5 - 20	9-10-11	(From 18 to 23 feet) tan dense very fine grain SAND. Very well sorted. Wet.
		E.O.B. @ 23 feet.

MCO 6565885

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-12-87
Prepared by Kevin Phillips

Depth (ft) Description

EE-03



Boring/Well No. H-8/EE-03
Location Site H
Owner IEPA
Top of Inner Casing Elev. 411.47
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/9 & 1/12/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 35.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 27 - 32 ft.
Screen Type stainless steel 0.01" slot
Stickup 2.36
Well Type monitoring
Well Construction:
Filter Pack 32 - 24 ft.
Seal 24 - 22 ft.
Grout 22 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 394.74 Date 3-26-87
Static Water Elev. 398.72 Date 5-11-87
Slug Test Yes X No
Test Date 5-11-87
Hydraulic Conductivity 10×10^{-3} cm/sec
Other pH = 7.3
Cond. = 2800 umhos Temp. = 56° F
Yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments Subsurface soil samples from boring 5 - 15' analyzed for HSL compounds.

REMARKS

Slight organic odor

MCO 6565896

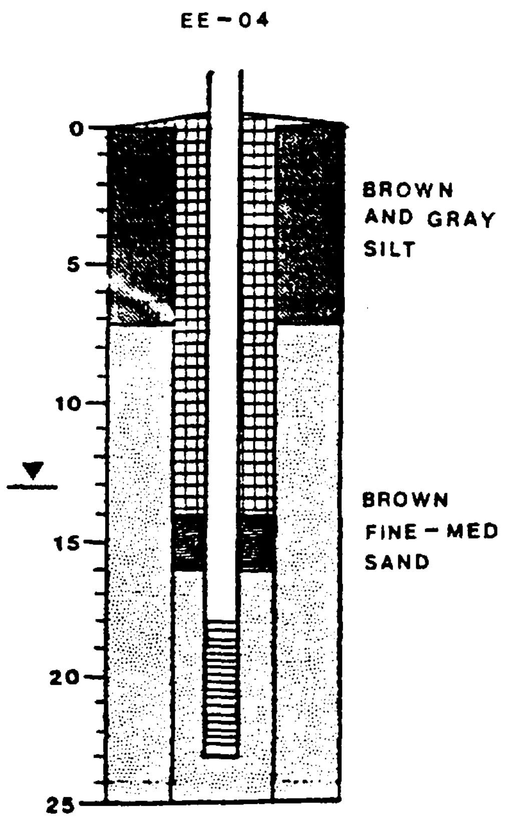
Site Dead Creek Site-H

Boring/Well No. H-8/well #EE-03

Sample Depth	Blow Count	Description
		0-1.5 Black cinders
1 - 2.5	4-5-7	1.5-2.5 Brown and gray silty CLAY. Trace of small gravel, brick, and concrete fragments.
3.5 - 5	4-5-1	FILL same as above.
6 - 7.5	8-12-11	FILL consisting of black and gray silty CLAY (possibly stained). 2 inches of black granular material and small spherical beads @ 7'. WASTE (moist)
8.5 - 10	30/2	WASTE - no recovery (rod bounced, probably rubber material).
		Water @ 11' while drilling.
11 - 12.5	1-1-1	Gray very sandy SILT. Some fine grain sand. Wet. Slight chemical odor.
13.5 - 15	2-3-5	Gray firm very sandy silty CLAY. Some fine grain sand and silt. Horizontally bedded and slightly varved. Occasional fractures containing iron-like staining. Moist.
16 - 17.5	1-2-3	Same as above; bedding is 1/8" to 1/4" thick. Occasional fractures and root trails or burrows.
18.5 - 20	1-1-1	Gray loose very clayey SILT, some fine grain sand. No bedding. Wet.
21 - 22.5	1-2-3	Same as above; slightly bedded (1/8") and slightly varved.
23.5 - 25	1-1-1	Same as above.
26 - 27.5	3-4-7	Same as above. (Fine grain sand in tip of spoon).
28.5 - 30	6-6-10	From 27' dark gray fine grain SAND. Wet. Slight chemical odor.
33.5 -35	3-9-9	Firm gray fine to coarse grain SAND. Wet. Well rounded.
		E.O.B. @ 35'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-13-87
Prepared by Kevin Phillips

Depth (ft) Description



Boring/Well No. H-9/EE-04
Location Site H
Owner IEPA
Top of Inner Casing Elev. 413.26
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/13, 1/13/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 25 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.93 ft.
Well Type monitoring
Well Construction:
Filter Pack 23 - 16 ft.
Seal 16 - 14 ft.
Grout 14 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 398.07 Date 3-26-87
Static Water Elev. 399.01 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity $5.2 \times 10^{-?}$ cm/sec
Other pH = 7.2
Cond. = 2000 umhos Temp. = 58° F
Clear-yellow

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments Subsurface soil sample from boring from 15 - 25' analyzed for HSL organics

REMARKS

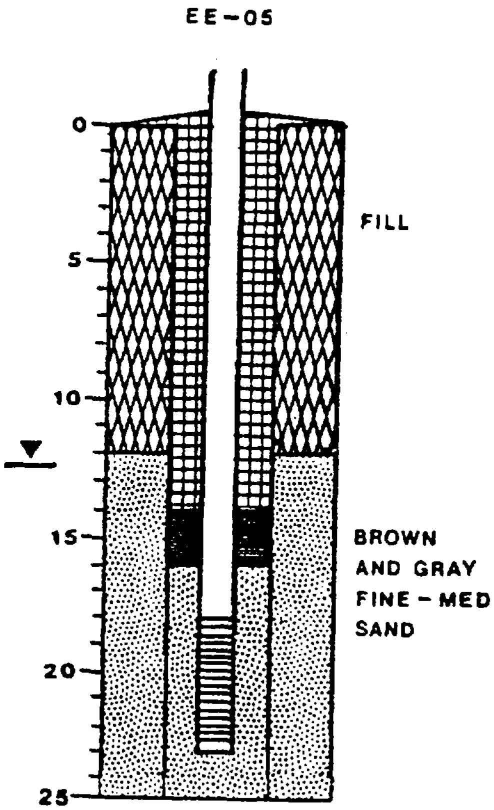
MCO 6565898

Site Dead Creek Site-H Boring/Well No. H-9/well #EE-04

Sample Depth	Blow Count	Description
1 - 2.5	5-5-3	0-2' Firm brownish-gray clayey SILT. Trace of fine grain sand. Moist. 2-2.5' Firm brown sandy SILT. Some fine grain sand. Dry.
3.5 - 5	3-4-6	Stiff brown and gray (mottled) very silty CLAY. Trace of fine grain sand. Occasional clayey silt layers (.2"). Moist.
6 - 7.5	3-5-8	Same as above; becomes increasingly siltier at 7' then grades into brown very fine SAND at 7 1/4'. Trace of silt. Dry.
8.5 - 10	3-5-7	Brown very fine grain SAND. Trace of silt. Dry.
11 - 12.5	2-2-5	Same as above; a 4 inch silty clay layer appears at 12'. Trace of fine grain sand.
13.5 - 15	2-6-8	Brown fine grain SAND. Wet.
16 - 17.5	2-6-7	Brown fine grain SAND. Some medium grain sand. Wet.
18.5 - 20	1-1-3	Brown medium grain SAND. Trace of coarse grain sand. Wet.
23.5 - 25	7-14-11	Brown medium grain SAND. Trace of coarse grain sand and small gravel. Wet.
		E.O.B. @ 25'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-14-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. G-2/EE-05
Location Site G
Owner IEPA
Top of Inner Casing Elev. 411.36
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/14, 1/14/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 25 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 2.3 ft.
Well Type monitoring
Well Construction:
Filter Pack 23 - 16 ft.
Seal 16 - 14 ft.
Grout 14 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 396.69 Date 3-26-87
Static Water Elev. 398.17 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other pH = 5.2
Cond. = 2200 umhos Temp. = 56° F

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-18-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes X No ___
Recipient Enviropact

Comments Subsurface soil sample from boring 5 - 15' analyzed for HSL compounds.

REMARKS

Slight organic odor

MCO 6565863

Site Dead Creek Site-G Boring/Well No. G-2/Well #EE-05

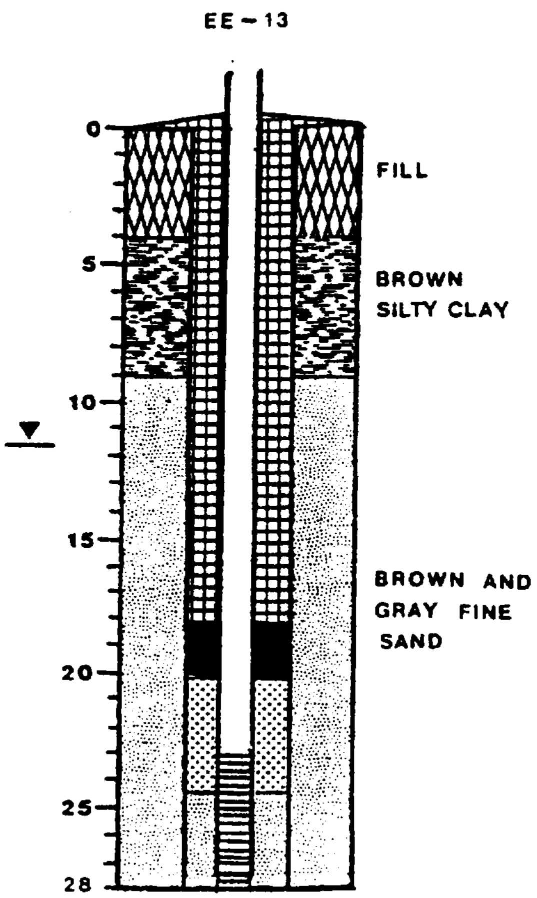
Sample Depth	Blow Count	Description
1 - 2.5	3-15-6	FILL consisting of black sandy CLAY with a variety of debris materials including slag, wood, crushed limestone, gravel, and iron fragments (dry).
3.5 - 5	3-5-3	FILL same as above (dry).
6 - 7.5	1-1-1	FILL consisting of brown silty CLAY. Trace of coarse grain sand and paper products (dry).
8.5 - 10	1-0-1	FILL consisting of light gray silty CLAY. Trace of asphalt and a purple paint-like residue substance (dry).
11 - 12.5	1-3-5	FILL (to 12 feet) consisting of dark brown silty CLAY. From 12 feet is gray medium grain sand (moist).
13.5 - 15	3-4-5	Brown-gray medium grain SAND (wet).
16 - 17.5	2-5-10	Brown fine grain SAND. Trace of silt (wet).
18.5 - 20	1-1-5	Same as above. With less silt.
23.5 - 25	7-14-18	Gray fine grain SAND. Trace of silt (wet).
		E.O.B. @ 25

Site Dead Creek Site-I Boring/Well No. I-1/Well # EE-12

Sample Depth	Blow Count	Description
		Crushed limestone and gravel on surface - parking lot for semi-trailers.
1 - 2.5	5-6-7	FILL consisting of brown-black sandy CLAY including a mixture of asphalt, fine to coarse grain sand, large gravel, and slag. Dry.
3.5 - 5	3-4-6	WASTE consisting of brown-black gravelly SAND including slag, stained paper and wood products, and a white gravelly substance. Dry.
6 - 7.5	3-5-4	WASTE. Same as above; with more slag and small spherical beads. Dry.
8.5 - 10	7-2-1	WASTE - poor recovery; probably same as above.
11 - 12.5	4-2-1	WASTE - same as above; wet.
13.5 - 15	7-10-14	WASTE consisting of black (oily stained) sludge-like material including wood chips, coarse grain sand, and concrete fragments. Wet.
16 - 17.5	1-3-4	WASTE. Same as above; with brick and concrete fragments, sand and gravel, and soft clay. Wet.
18.5 - 20	4-3-1	WASTE. Same as above. Fill material discontinues @ 21'.
21 - 22.5	0-0-2	21-22' Dark gray fine grain SAND. Some black staining. Wet. 22-22.5 Dark gray silty CLAY. Moist.
23.5 - 25	2-2-2	Dark gray silty CLAY. Moist.
26 - 27.5	0-0-1	Dark gray to black fine grain SAND. Trace of silt and medium grain SAND. Wet.
28.5 - 30	6-8-10	Dark gray medium to coarse grain SAND. Wet.
31 - 32.5	7-8-9	Same as above; with a trace of small gravel. Wet.
		E.O.B. @ 33.5"

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-29-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. I-4/EE-13
Location Site I
Owner IEPA
Top of Inner Casing Elev. 409.16
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/29,1/29/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 28.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 23 - 28 ft.
Screen Type stainless steel 0.01" slot
Stickup 0.52 ft.
Well Type monitoring
Well Construction:
Filter Pack 28 - 20 ft.
Seal 20 - 18 ft.
Grout 18 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.47 Date 3-26-87
Static Water Elev. 398.75 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity 1.3×10^{-4} cm/sec
Other pH = 7.2
Cond. = 1800 umhos Temp. = 56° F
Clear to yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-23-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes X No
Recipient Sverdrup, Inc. for Cerro Copper

Comments

REMARKS

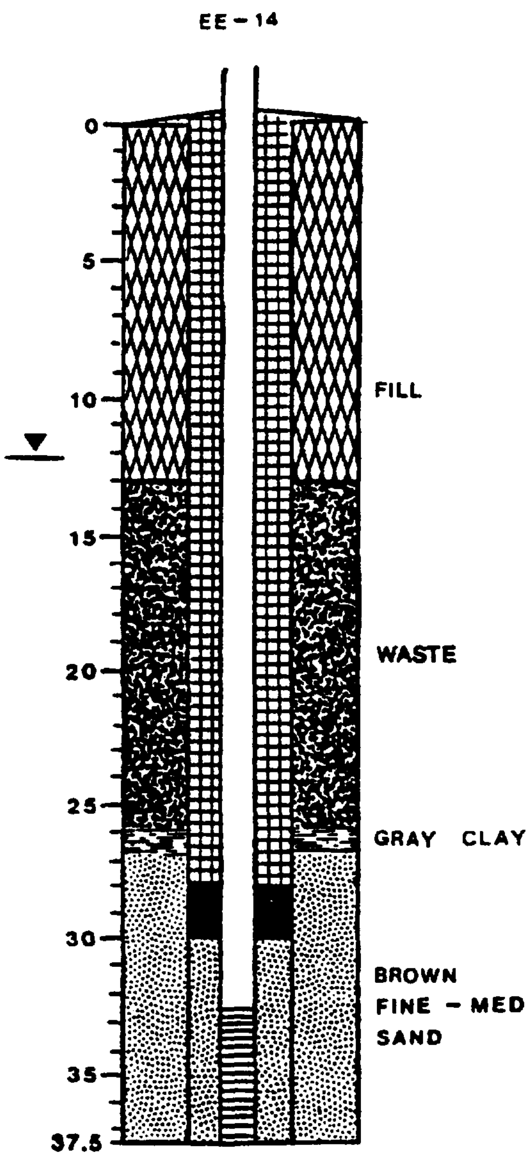
Site Dead Creek Site-I

Boring/Well No. I-4/Well # EE-13

Sample Depth	Blow Count	Description
		Fill on surface.
1 - 2.5	8-7-50	FILL consisting of brown and black sandy CLAY, including a mixture of crushed limestone, small to medium gravel, and concrete fragments.
		Fill discontinues @ approx. 4'.
3.5 - 5	3-4-4	From 4', brown very silty CLAY. Dry.
6 - 7.5	3-4-5	Brown silty CLAY; to 9'.
8.5 - 10	2-3-2	From 9', brown very fine grain SAND. Some silt. Thinly bedded. Water @ 9.5'.
11 - 12.5	1-3-2	Same as above.
13.5 - 15	1-1-1	Same as above; some interbedding of siltier material. Wet.
16 - 17.5	1-2-3	Same as above; to 19'.
18.5 - 20	1-2-3	From 19', brown (turning gray) SILT. Wet.
21 - 22.5	1-2-2	Gray fine grain SAND. Wet.
23.5 - 25	0-1-0	Same as above.
26 - 27.5	0-1-2	Same as above.
		E.O.B. @ 28'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 1-30-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. I-5/EE-14
Location Site I
Owner IEPA
Top of Inner Casing Elev. 410.95
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 1/30, 1/30/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers, Rotary

WELL DATA

Hole Diam. 8 in.
Boring Depth 37.5 ft.
Casing and Screen Diam. 2 in.
Screen Interval 32.5 - 37.5 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.56 ft.
Well Type monitoring
Well Construction:
Filter Pack 37.5 - 30 ft. Natural
Seal 30 - 28 ft.
Grout 28 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.23 Date 3-26-87
Static Water Elev. 398.55 Date 5-11-87
Slug Test Yes___ No X
Test Date
Hydraulic Conductivity
Other pH = 7.4
Cond. = 3400 umhos Temp. = 56° F
Cloudy, yellowish

WATER QUALITY

Samples Taken Yes X No___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-23-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes X No___
Recipient Sverdrup, Inc. for Cerro Copper

Comments Subsurface soil samples from boring 5' - 27.5 feet and 28.5 - 37.5 feet analyzed for HSL compounds.

REMARKS

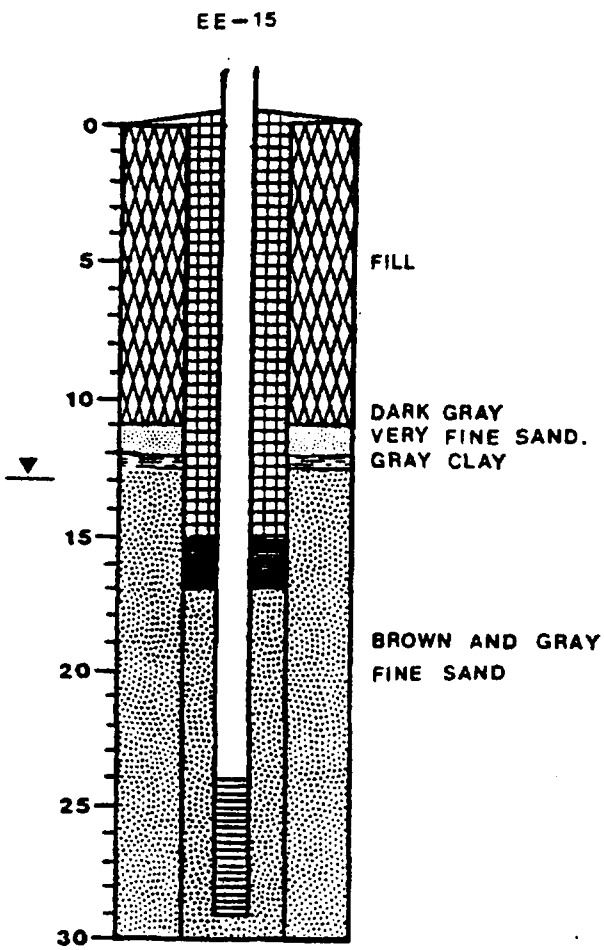
MCO 6565909

Site Dead Creek Site-I　　　　Boring/Well No. I-5/Well #EE-14

Sample Depth	Blow Count	Description
		Crushed limestone parking lot surface.
1 - 2.5	24-00	FILL consisting of dark brown-black sandy CLAY including a mixture of fine to coarse grain sand, limestone fragments, clay, and concrete (large obstruction caused spoon refusal).
3.5 - 5	4-6-8	FILL consisting of black-gray silty CLAY.
6 - 7.5	11-14-8	FILL consisting of light gray-black sandy CLAY including crushed limestone, small to large gravel, fine to coarse grain sand, and wood chips. Dry.
8.5 - 10	4-17-4	FILL - same as above; with some brick fragments.
11 - 12.5	2-2-1	FILL consisting of gray silty CLAY. Some black staining, trace of fill debris including cloth products and cinders.
13.5 - 15	2-2-3	WASTE consisting of black sandy CLAY including a mixture of cinders, slag, small to large gravel, and fine to coarse grain sand. (Moist)
16 - 17.5	4-2-5	No recovery - probably same fill material. Water @ 17.5'.
18.5 - 20	3-5-3	WASTE consisting of black sandy CLAY including some gravel and slag. Wet (with oily sheen).
21 - 22.5	4-1-5	No recovery - probably same fill material.
23.5 - 25	5-9-5	WASTE - same as above. Fill apparently discontinues @ approx. 26'.
26 - 27.5	4-2-3	26-26 3/4' Black-gray-brown silty CLAY then black very fine grain SAND Some silt and black staining. Wet.
28.5 - 30	3-4-3	Black very fine grain SAND. Stained. Wet. From 29-29 1/4' is a gray silty CLAY layer. Then brown fine grain SAND. Slightly stained. Wet. Trace of medium grain sand.
31 - 32.5	2-4-2	Brown fine to medium grain SAND. Wet.
36 - 37.5	8-16-24	Brown medium to coarse grain SAND. Trace of small gravel. Wet. Tip of spoon (37.5') showed dark gray very fine grain SAND. Trace of small gravel.
		E.O.B. @ 37.5'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-3-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. I-7/EE-15
Location Site I
Owner IEPA
Top of Inner Casing Elev. 406.41
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/3/87,2/3/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers, Rotary

WELL DATA

Hole Diam. 8 in.
Boring Depth 30 ft.
Casing and Screen Diam. 2 in.
Screen Interval 24 - 29 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.33 ft.
Well Type monitoring
Well Construction:
  Filter Pack 29 - 17 ft. Natural
  Seal 17 - 15 ft.
  Grout 15 ft. to surface
  Lock No. 2834

TEST DATA

Static Water Elev. 397.63 Date 3-26-87
Static Water Elev. 398.93 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity 0.47 x10^{-4} cm/sec
Other pH = 7.2
Cond. = 1800 umhos Temp. = 56° F
Yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-23-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes X No
Recipient Sverdrup, Inc. for Cerro Copper

Comments Subsurface soil samples from boring 3.5 - 12.5 feet and 13.5 - 22.5 feet analyzed for HSL compounds.

REMARKS

Slight odor

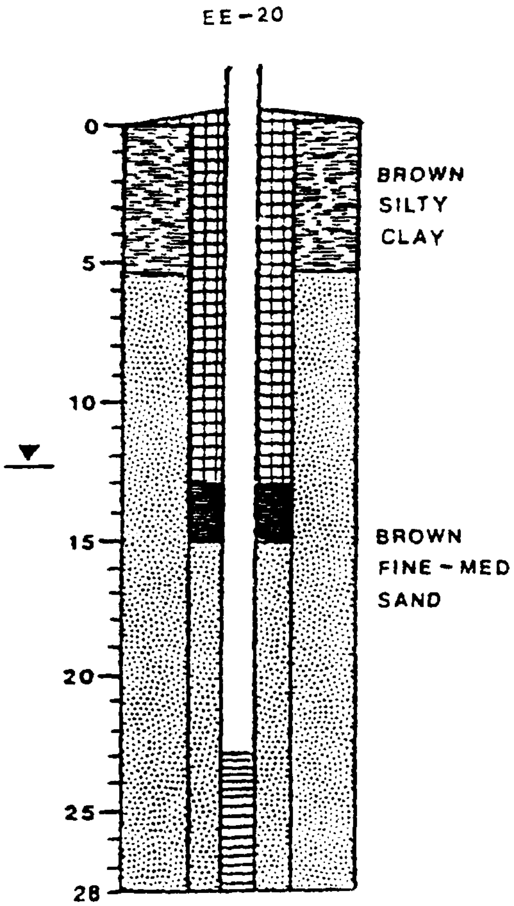
MCO 6565913

Site Dead Creek Site-I Boring/Well No. I-7/Well #EE-15

Sample Depth	Blow Count	Description
		0-1 Black clayey topsoil
1 - 2.5	3-3-4	FILL consisting of brown-gray silty CLAY. Dry.
3.5 - 5	4-8-4	FILL consisting of brown-gray silty CLAY. Trace of fine grain sand and crushed limestone. Dry.
6 - 7.5	1-1-1	FILL - same as above. Moist.
8.5 - 10	3-4-8	FILL consisting of brown-gray-black silty CLAY. Some fine to medium grain sand and crushed limestone. Dry.
		Fill apparently discontinues @ approx. 11'.
11 - 12.5	1-3-4	11-12' Dark gray very fine grain SAND. Moist. 12-12.5 Soft gray silty CLAY. Moist. Water @ 13'.
13.5 - 15	1-3-	Brown fine grain SAND. Wet.
16 - 17.5	1-3-5	Same as above.
18.5 - 20	2-6-8	Same as above; slightly siltier.
21 - 22.5	12-15-15	Same as above; less silt.
23.5 - 25	5-8-12	Gray very fine grain SAND. Wet.
26 - 27.5	12-10-10	Same as above.
28.5 - 30	6-8-10	Same as above.
		E.O.B. @ 30'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-13-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. I-12/EE-20
Location Site I
Owner IEPA
Top of Inner Casing Elev. 411.41
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/13, 2/13/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers, Rotary

WELL DATA

Hole Diam. 8 in.
Boring Depth 28 ft.
Casing and Screen Diam. 2 in.
Screen Interval 23 - 28 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.41 ft.
Well Type monitoring
Well Construction:
Filter Pack 28 - 15 ft. Natural
Seal 15 - 13 ft.
Grout 13 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.49 Date 3-26-87
Static Water Elev. 398.91 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-23-87
Samplers E & E
Samples Analyzed for HSL compounds, volatile organics

Split Samples Yes X No ___
Recipient Sverdrup, Inc. for Cerro Copper

Comments Subsurface soil samples from boring 3.5 - 12.5 feet analyzed for HSL compounds.

REMARKS

Background location

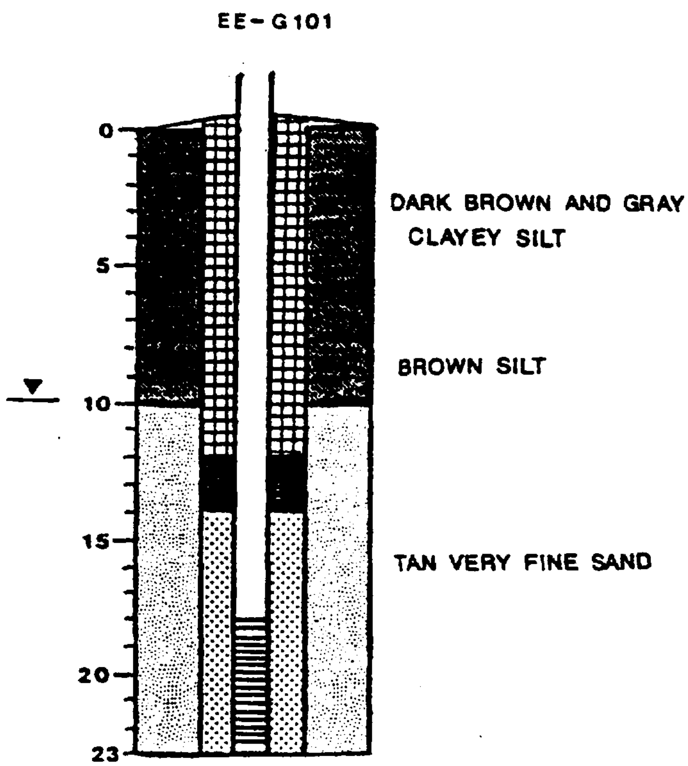
MCO 6565924

Site Dead Creek Site-I | Boring/Well No. I-12/Well #EE-20

Sample Depth	Blow Count	Description
		Dark brown sandy clay topsoil on surface.
1 - 2.5	2-3-2	Brown silty CLAY. Dry.
3.5 - 5	3-3-2	Same as above.
6 - 7.5	3-3-5	Brown fine to medium grain SAND. Dry.
8.5 - 10	3-5-8	Same as above.
11 - 12.5	3-5-8	Same as above. Moist @ 12.5'.
13.5 - 15	4-8-13	Same as above. Wet.
16 - 17.5	1-2-4	Same as above.
18.5 - 20	2-5-9	Same as above.
21 - 22.5	3-5-11	Same as above.
23.5 - 25	4-7-11	Brown medium grain SAND. Wet. Trace of coarse grain sand @ 24-25'.
26 - 27.5	7-11-20	Same as above. Trace of small gravel. Wet.
		E.O.B. @ 28'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-25-87
Prepared by Kevin Phillips

Depth (ft) Description



(IEPA well replaced)
Boring/Well No. EE-G101
Location Site G
Owner IEPA
Top of Inner Casing Elev. 412.35
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/25, 2/25/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D.
hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 23 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 2.51 ft.
Well Type monitoring
Well Construction:
Filter Pack 22.5 - 14 ft.
Seal 14 - 12 ft.
Grout 12 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 396.86 Date 3-26-87
Static Water Elev. 398.22 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity 1.3 x 10 cm/sec
Other pH = 7.0
Cond. = 1600 umhos Temp. = 58° F
Cloudy, yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments

REMARKS

MCO 6565849

Site Dead Creek Site-G

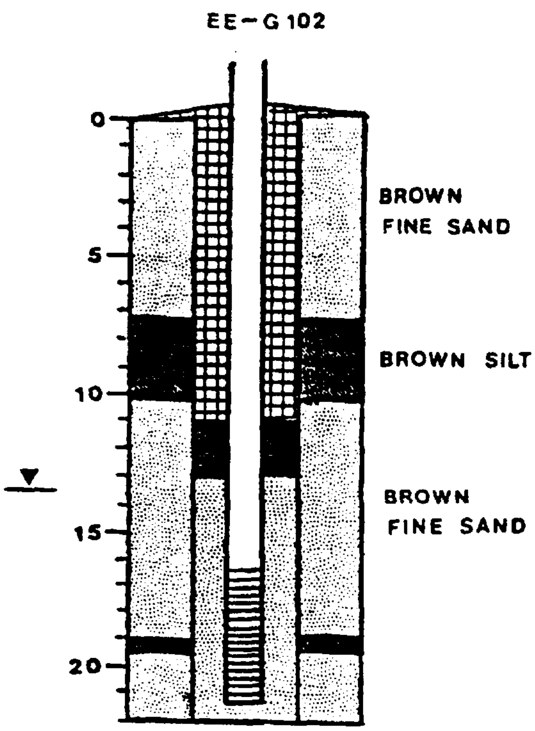
Boring/Well No. Well #EE-G101
IEPA replacement well

Sample	Depth	Blow Count	Description
			Straight drill boring. Stratigraphic sequence description taken from IEPA report (April 1981) log for monitoring well G-101 boring no. B-1 (10-8-80). 0-7.5' Dark brown and gray clayey SILT. Trace of natural organics. 7.5-10' Brown micaceous SILT. Water level @ 9.5'. 10-15' Tan very fine grain SAND. Arenitic; moderately sorted to rounded. Contains ferro-magnesian minerals. 15-32' Tan fine to coarse grain SAND. Arkosic, moderately rounded, poorly sorted, contains ferro-magnesian minerals with some medium gravel. E.O.B. @ 23 ft. (for replacement well #EEG101)

(IEPA well replaced)

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-26-87
Prepared by Kevin Phillips

Depth (ft) Description



Boring/Well No. EE-G102
Location Site G
Owner IEPA
Top of Inner Casing Elev. 409.10
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/26, 2/26/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 21.5 ft.
Casing and Screen Diam. 2 in.
Screen Interval 16.5 - 21.5 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.22 ft.
Well Type monitoring
Well Construction:
Filter Pack 22 - 13 ft. Natural
Seal 13 - 11 ft.
Grout 11 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.37 Date 3-26-87
Static Water Elev. 398.57 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity 1.4 x 10 cm/sec
Other pH = 6.8
Cond. = 1000 umhos Temp. = 56° F
Clear to yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-24-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments

REMARKS

IEPA well

MCO 6565851

Site Dead Creek Site-G

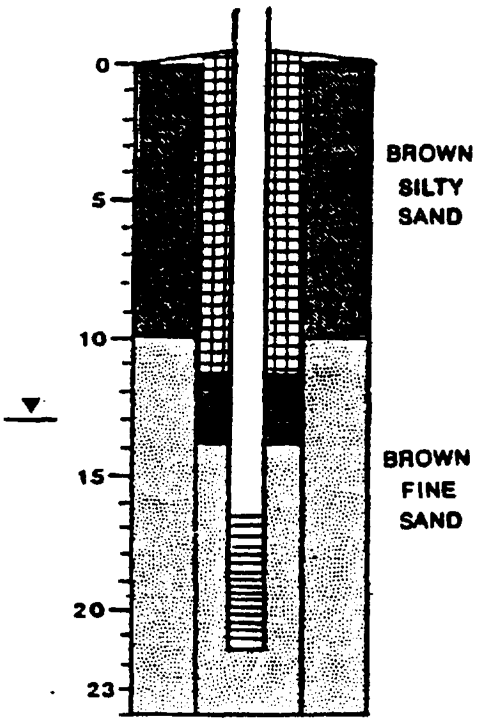
Boring/Well No. Well #EE-G102
(replacement well for
IEPA G-102)

Sample Depth	Blow Count	Description
3.5 - 5	2-3-5	0-5 Loose brown silty fine grain SAND. Trace to little silt. Moist.
8.5 - 10	2-2-4	Loose brown sandy SILT. Some fine grain sand. Very moist.
13.5 - 15	2-3-5	Loose brown fine grain SAND. Well sorted and rounded to sub-rounded. Wet.
18.5 - 20	1-2-4	18.5-19 Gray silty fine grain SAND. Wet. 19'-19'10" - Gray very sandy SILT. Wet. 19'10"-20' - Gray very silty fine grain SAND. Wet. 20-21.5" - Gray fine, coarse grain sand (from IEPA log). E.O.B. @ 21.5'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-26-87
Prepared by Kevin Phillips

Depth (ft) Description

EE-G103



(IEPA well replaced)
Boring/Well No. EE-G103
Location Site G
Owner IEPA
Top of Inner Casing Elev. 408.74
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/26, 2/26/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 23.5 ft.
Casing and Screen Diam. 2 in.
Screen Interval 16.5 - 21.5 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.08 ft.
Well Type monitoring
Well Construction:
Filter Pack 22 - 14 ft. Natural
Seal 14 - 11.5 ft.
Grout 11.5 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.43 Date 3-26-87
Static Water Elev. 398.57 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other pH = 5.2
Cond. = 1200 umhos Temp. = 56° F
Cloudy, yellowish

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes ___ No X
Recipient

Comments

REMARKS

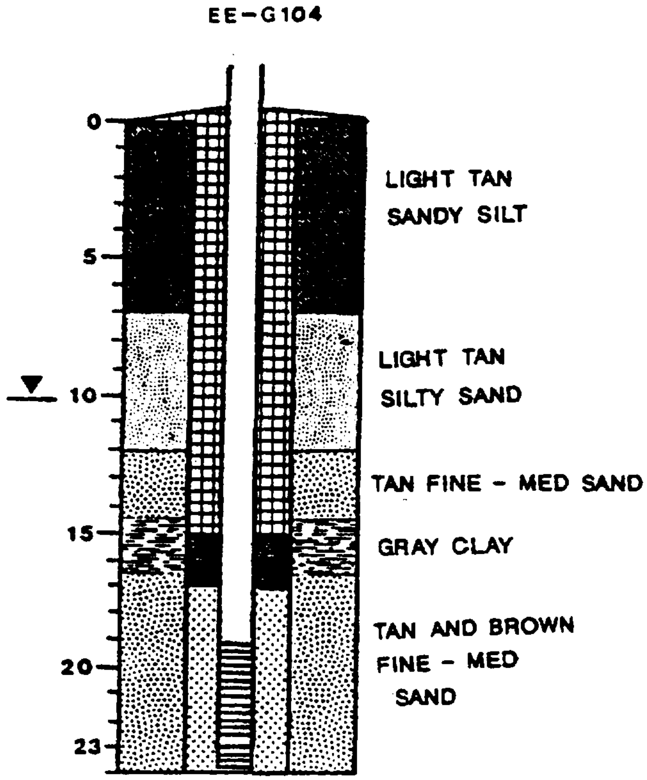
MCO 6565853

Site Dead Creek Site-G Boring/Well No. Well #EE-G103

Sample Depth	Blow Count	Description
		Straight drill to 8.5'.
		Stratigraphic sequence based on auger cuttings.
8.5 - 10	7-9-10	0-10 Firm brown very silty fine grain SAND. Some silt. Sand is well sorted and rounded to sub-rounded. Moist.
13.5 - 15	5-17-12	Firm brown fine grain SAND. Well sorted. Some black stained stringers throughout. Wet. Slight chemical odor.
18.5 - 20	1-2-3	Loose brown fine grain SAND. Well sorted and rounded. Trace of natural organic layers and wood particles. Wet.
22 - 23.5	5-9-9	Firm brown fine grain SAND. Trace of medium grain sand and small gravel.
		E.O.B. @ 23.5'.

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-25-87
Prepared by Kevin Phillips

Depth (ft) Description



(IEPA well replaced)
Boring/Well No. EE-G104
Location Site G
Owner IEPA
Top of Inner Casing Elev. 408.96
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/25, 2/25/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 24 ft.
Casing and Screen Diam. 2 in.
Screen Interval 19 - 24 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.09 ft.
Well Type monitoring
Well Construction:
Filter Pack 24 - 17 ft.
Seal 17 - 15 ft.
Grout 15 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.01 Date 3-26-87
Static Water Elev. 398.24 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other pH = 6.5
Cond. = 1000 umhos Temp. = 54° F

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-17-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes ___ No X
Recipient

Comments

REMARKS

MCO 6565855

Site Dead Creek Site-G

Boring/Well No. Well #EE-G104

Sample	Depth	Blow Count	Description
			Straight drill boring. Stratigraphic sequence description taken from IEPA report (April, 1981) log for monitoring well G-104 boring no. B-4 (10-9-80). 0-7 Light tan sandy SILT. Trace of clay. 7 - 12 Light tan silty SAND. Micaceous. 12-14.5 Tan fine to medium grain SAND. Arkosic. 14.5-16.5 Gray silty CLAY. 16.5-37.5 Tan and brown fine to medium grain SAND. Arkosic. Poorly sorted. Subrounded. Trace of small gravel. E.O.B. @ 24' (for replacement well # EEG 104)

Project Name	Dead Creek
Project No.	IL 3140
Date Prepared	1-27-87
Prepared by	Tim Maley

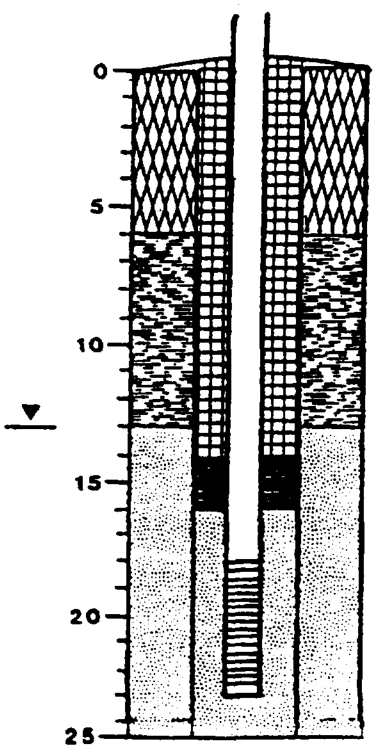
(IEPA well replaced)

Boring/Well No.	G-4/EE-G106
Location	Site G
Owner	IEPA
Top of Inner Casing Elev.	407.97
Drilling Firm	Fox drilling
Driller	Jerry Hammon
Start & Completion Dates	1/26, 1/27/87
Type of Rig	Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

Depth (ft) Description

EE-G106



WELL DATA

Hole Diam. 8 in.
Boring Depth 25 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.44 ft.
Well Type monitoring
Well Construction:
- Filter Pack 23 - 16 ft. Natural
- Seal 16 - 14 ft.
- Grout 14 ft. to surface
- Lock No. 2834

TEST DATA

Static Water Elev. 397.40 Date 3-26-87
Static Water Elev. 398.52 Date 5-11-87
Slug Test Yes ____ No X
Test Date ____
Hydraulic Conductivity ____
Other pH = 7.4
Cond. = 4200 umhos Temp. = 58° F
Dark, cloudy Strong organic odor

WATER QUALITY

Samples Taken Yes X No ____
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-24-87
Samplers E & E
Samples Analyzed for HSL compounds, volatile organics

Split Samples Yes ____ No X
Recipient ____

Comments Subsurface soil samples from boring 5 - 20' analyzed for HSL compounds.

REMARKS

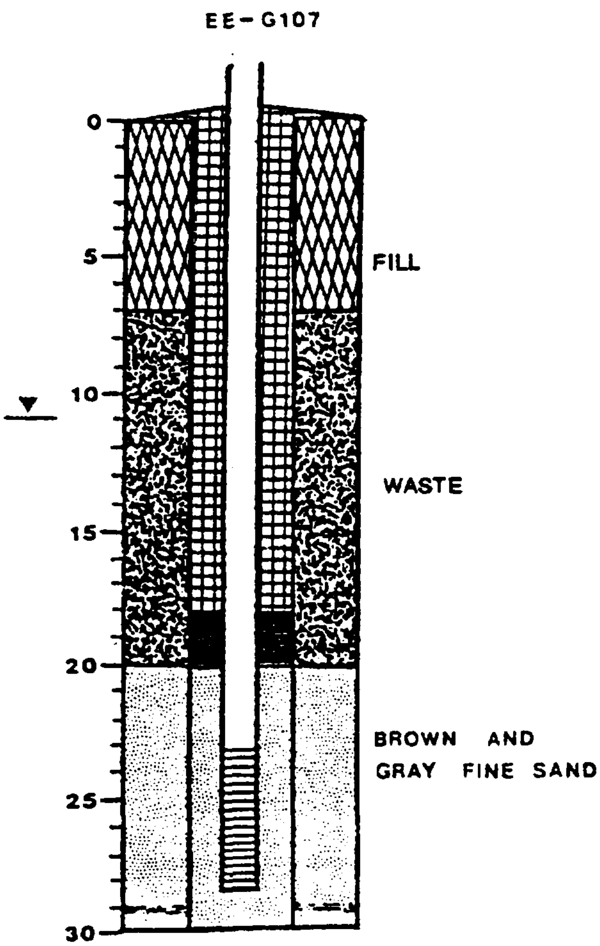
Site Dead Creek Site-G

Boring/Well No. G-4/well #EE-G106
(IEPA replacement well)

Sample Depth	Blow Count	Description
1 - 2.5	15-7-9	FILL 0-1.5' Black sandy CLAY 1.5-2' Crushed limestone From 2' Gray silty clay. Trace of fine grain sand (dry).
3.5 - 5	1-2-2	FILL consisting of brown-black (mottled) silty CLAY. Trace of rust color and fine grain sand (dry). FILL discontinues @ approx. 6'.
6 - 7.5	1-0-2	Gray silty CLAY. Trace of very fine grain sand (moist).
8.5 - 10	1-2-2	Same as above with increased moisture and very fine grain sand.
11 - 12.5	1-2-2	Same as above. Some black staining at 12'.
13.5 - 15	1-2-5	Dark gray very fine grain SAND. Trace of silt and black staining (wet).
16 - 17.5	0-1-3	Black fine grain SAND (stained). Light and dark laminated banding of black staining (wet).
18.5 - 20	1-2-5	Dark gray fine grain SAND (wet).
21 - 22.5	4-9-8	Black fine grain SAND. Trace of silt (wet).
23.5 - 25	7-13-21	Gray fine grain SAND (wet).
		E.O.B. @ 25'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-23-87
Prepared by Kevin Phillips

Depth (ft) Description



(IEPA well replaced)
Boring/Well No. G-6/EE-G107
Location Site G
Owner IEPA
Top of Inner Casing Elev. 406.67
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/23, 2/23/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers, Rotary

WELL DATA

Hole Diam. 8 in.
Boring Depth 30 ft.
Casing and Screen Diam. 2 in.
Screen Interval 23 - 28 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.12 ft.
Well Type monitoring
Well Construction:
Filter Pack 28 - 23 ft.
Seal 20 - 18 ft.
Grout 18 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.15 Date 3-26-87
Static Water Elev. 398.32 Date 5-11-87
Slug Test Yes____ No X
Test Date
Hydraulic Conductivity
Other pH = 4.8
Cond. = 3600 umhos Temp. = 62° F

WATER QUALITY

Samples Taken Yes X No____
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-18-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes X No____
Recipient Enviropact

Comments

REMARKS

MCO 6565871

Site Dead Creek Site-G

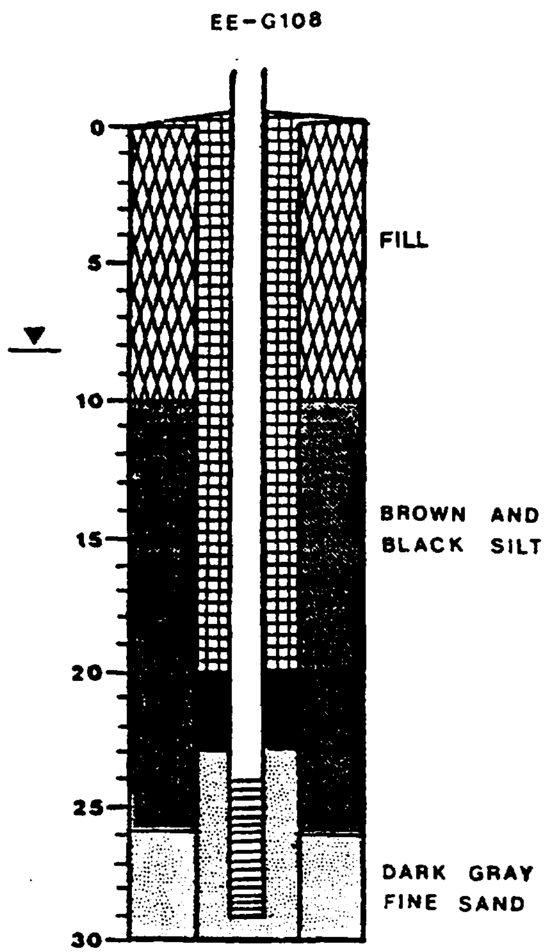
Boring/Well No. G-6/Well #EE-G107
(IEPA Replacement well)

Sample Depth	Blow Count	Description
0 - 2.5	15-3-5	FILL consisting of loose fine to medium grain SAND. Trace of medium gravel, slag, and wood particles. (moist)
3.5 - 5	1-1-2	No recovery. Possible void in fill/debris material.
6 - 7.5	11-14-7	FILL consisting of various debris including wood particles, rubber, sand, and gravel. (moist)
8.5 - 10	2-3-24	WASTE consisting of black flaky material. Shale-like and fissile. (dry)
11 - 12.5	5-1-2	WASTE - same as above. (wet)
13.5 - 15	3-2-1	WASTE consisting of small to medium crushed gravel and cloth products. (wet)
16 - 17.5	1-1-1	WASTE - same as above with paper products. (wet)
18.5 - 20	1-1-1	WASTE consisting of black silty sludge. Some glass fragments and gravel. (wet) WASTE discontinues @ approx. 20'.
21 - 22.5	1-2-2	Brown-gray silty fine grain SAND. Well sorted and well rounded. 3 inch varved sandy silt layer in tip of spoon, sample stained throughout (wet).
23.5 - 25	1-3-3	Same as above. Obvious staining throughout sample. Soft gray silty organic clay layer @ 24'-24'3". (wet)
28.5 - 30	8-12-12	28.5'-29' Brown fine grain SAND. Trace of silt. (wet) 29'-29'2" Gray very silty organic CLAY. Trace of fine grain sand. 29'2"-30' Black stained fine to medium grain SAND. Well sorted and well rounded. (wet) E.O.B. @ 30'

(IEPA well replaced)

Project Name: Dead Creek	Boring/Well No.: EE-G108
Project No.: IL 3140	Location: Site G
Date Prepared: 3-2-87	Owner: IEPA
Prepared by: Kevin Phillips	Top of Inner Casing Elev.: 407.21
	Drilling Firm: Fox drilling
	Driller: Jerry Hammon
	Start & Completion Dates: 3/2/87,3/2/87
	Type of Rig: Mobile B-61

Depth (ft) Description



Method of Drilling: 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam.: 8 in.
Boring Depth: 30 ft.
Casing and Screen Diam.: 2 in.
Screen Interval: 24 - 29 ft.
Screen Type: stainless steel 0.01" slot
Stickup: 0.93 ft.
Well Type: monitoring
Well Construction:
- Filter Pack: 29 - 22 ft.
- Seal: 22 - 20 ft.
- Grout: 20 ft. to surface
- Lock No.: 2834

TEST DATA

Static Water Elev. 397.96 Date 3-26-87
Static Water Elev. 398.85 Date 5-11-87
Slug Test Yes ___ No X
Test Date ___
Hydraulic Conductivity ___
Other pH = 5.4
Cond. = 1800 umhos Temp. = 56° F
Clear to cloudy No odor

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples: 1 round
Types of Samples: groundwater

Date Sampled: 3-18-87
Samplers: E & E
Samples Analyzed for: HSL compounds

Split Samples Yes X No ___
Recipient: Enviropact

Comments ___

REMARKS

MCO 6565857

Site Dead Creek

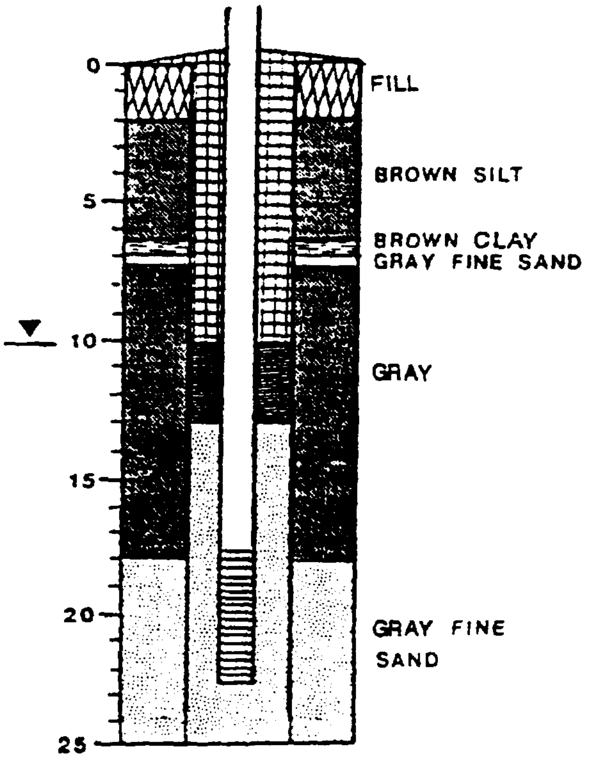
Boring/Well No. Well #EE-G108
(replacement well for IEPA G-108)

Sample	Depth	Blow Count	Description
			Straight drill to 23.5'
			Stratigraphy sequence based on auger cuttings.
			0-10 FILL consisting of brown-black very silty CLAY.
			10-23.5 Brown clayey SILT.
			23.5-25 Black very sandy SILT. Some fine grain sand. Very moist.
			28.5-30 Black to dark gray silty fine SAND. Well sorted. Wet.
			E.O.B. @ 30'.

Project Name Dead Creek
Project No. IL 3140
Date Prepared 12-16-86
Prepared by Tim Maley

Depth (ft) Description

EE-G109



(IEPA well replaced)
Boring/Well No. L-4/EE-G109
Location Site L
Owner IEPA
Top of Inner Casing Elev. 409.71
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 12/16,12/16/86
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 25.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 17.5 - 22.5 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.94 ft.
Well Type monitoring
Well Construction:
Filter Pack 25 - 13 ft.
Seal 13 - 10 ft.
Grout 10 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.42 Date 3-26-87
Static Water Elev. 398.45 Date 5-11-87
Slug Test Yes ___ No X
Test Date
Hydraulic Conductivity
Other pH = 5.0
Cond. = 4500 umhos Temp. = 58° F
Cloudy, dark, strong odor

WATER QUALITY

Samples Taken Yes X No ___
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-24-87
Samplers E & E
Samples Analyzed for HSL compounds, volatile organics

Split Samples Yes ___ No X
Recipient

Comments Subsurface soil samples from boring 10' - 20' analyzed for HSL compounds.

REMARKS

MCO 6565954

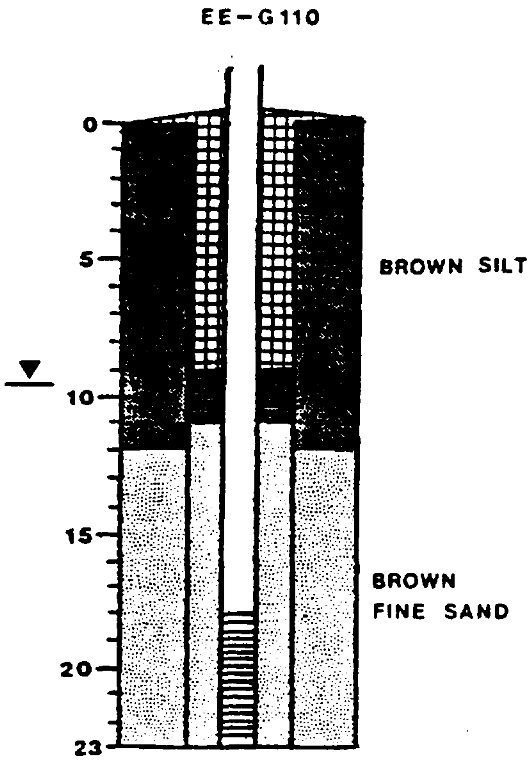
Site Dead Creek Site-L

Boring/Well No. L-4/Well # EE-G109
(IEPA Replacement Well)

Sample Depth	Blow Count	Description
		0-2' FILL consisting of black asphalt and clay.
1 - 2.5	5-6-7	from 2' Brown sandy SILT. Moist.
3.5 - 5	3-3-4	Brown sandy SILT. Trace of medium grain sand.
6 - 7.5	3-4-4	6.5-7 Brown silty CLAY. Trace of fine grain sand. 7-7.5 Gray fine grain SAND. Trace of silt and clay.
8.5 - 10	3-4-6	Brown-gray (mottled) clayey SILT. Trace of fine grain sand. Moist.
11 - 12.5	4-7-8	Gray sandy SILT. Wet.
13.5 - 15	6-11-13	Same as above. Trace of fine grain sand.
16 - 17.5	8-14-34	Stiff gray sandy SILT. Thin laminated black-gray layering.
18.5 - 20	8-13-15	Gray fine grain SAND. Wet.
21 - 22.5	9-12-17	Same as above.
23.5 - 25	7-14-18	Dark gray fine to coarse grain SAND. Some black staining. Wet.
		E.O.B. @ 25'

Project Name Dead Creek
Project No. IL 3140
Date Prepared 12-18-86
Prepared by Tim Maley

Depth (ft) Description



(IEPA well replaced)
Boring/Well No. EE-G110
Location Site G
Owner IEPA
Top of Inner Casing Elev. 409.00
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 12/18,12/18/86
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D. hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 23.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 18 - 23 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.82 ft.
Well Type monitoring
Well Construction:
Filter Pack 23 - 11 ft. Natural
Seal 11 - 9 ft.
Grout 9 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.49 Date 3-26-87
Static Water Elev. 398.52 Date 5-11-87
Slug Test Yes X No
Test Date 5-13-87
Hydraulic Conductivity 5.3 x 10 cm/sec
Other pH = 6.8
Cond. = 1200 umhos Temp. = 58° F
Clear to yellowish

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-24-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments

REMARKS

MCO 6565859

Site Dead Creek Site-G

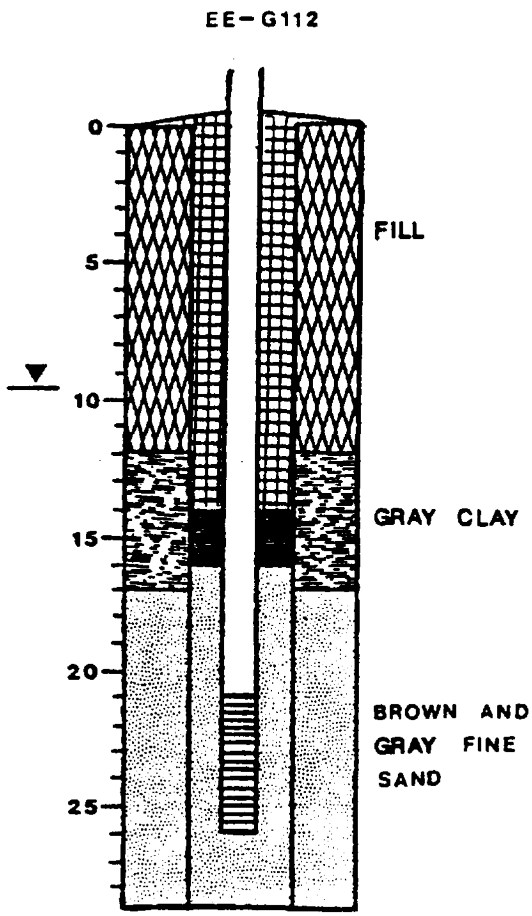
Boring/Well No. Well #EE-G110
IEPA replacement well

Sample Depth	Blow Count	Description
		Straight drill to 13.5'.
		Stratigraphic sequence based on auger cuttings.
		0 to 1' black topsoil.
		1 to 12' brown sandy SILT
		Begin sampling at 13.5'.
13.5 - 15	3-7-6	Brown silty SAND. Wet.
18.5 - 20	3-4-5	Brown to gray fine to medium grain SAND. Wet.
		E.O.B. @ 23'

(IEPA well replaced)

Project Name Dead Creek
Project No. IL 3140
Date Prepared 2-3-87
Prepared by Tim Maley

Depth (ft) Description



Boring/Well No. I-8/EE-G112
Location Site I
Owner IEPA
Top of Inner Casing Elev. 407.87
Drilling Firm Fox drilling
Driller Jerry Hammon
Start & Completion Dates 2/3/87,2/3/87
Type of Rig Mobile B-61

Method of Drilling 3 3/4" I.D.
hollow stem augers

WELL DATA

Hole Diam. 8 in.
Boring Depth 29.0 ft.
Casing and Screen Diam. 2 in.
Screen Interval 21 - 26 ft.
Screen Type stainless steel 0.01" slot
Stickup 1.19 ft.
Well Type monitoring
Well Construction:
Filter Pack 26 - 16 ft. Natural
Seal 16 - 14 ft.
Grout 14 ft. to surface
Lock No. 2834

TEST DATA

Static Water Elev. 397.00 Date 3-26-87
Static Water Elev. 398.39 Date 5-11-87
Slug Test Yes X No
Test Date 5-12-87
Hydraulic Conductivity 3.4 x 10 cm/sec
Other ph = 7.6
Cond. = 1600 umhos Temp. = 58° F
Yellowish, slight odor

WATER QUALITY

Samples Taken Yes X No
No. of Samples 1 round
Types of Samples groundwater

Date Sampled 3-23-87
Samplers E & E
Samples Analyzed for HSL compounds

Split Samples Yes No X
Recipient

Comments

REMARKS

MCO 6565915

Site Dead Creek Site-I

Boring/Well No. I-8/Well #EE-G112
IEPA replacement well

Sample Depth	Blow Count	Description
		Straight drill to 17.5'.
		Stratigraphic sequence based on auger cuttings.
		0'to 5' FILL consisting of brown fine to medium grain SAND including crushed limestone, gravel, and brick fragments.
		5'to 12' FILL consisting of black asphaltic sand and gravel including oily cinders and soft clay.
		Fill discontinues @ approx. 13'.
		12' to 17' Gray silty clay.
		17'to 23' Brown to gray fine grain SAND. Some silt. Wet.
		23 to 27.5' Brown to gray medium grain SAND. Trace of small gravel. Wet.
		27.5' to 27 3/4' Gray silty clay. Moist.
		27 3/4' to 29' Gray fine grain SAND.
Three samples taken for screen placement.		
17.5 - 19	2-3-4	Brown fine grain SAND. Wet.
22.5 - 24	4-5-7	Gray fine to medium grain SAND. Trace of coarse grain sand and small gravel. Wet.
27.5 - 29	6-7-9	4" gray silty clay layer on top of gray fine grain SAND. Wet.
		E.O.B. @ 29'

EE/CA and RI/FS Support Sampling Plan

Sauget Area 1

Sauget and Cahokia, Illinois

Volume 1B

Human Health Risk Assessment Work Plan

June 25, 1999

Submitted To:

U.S. Environmental Protection Agency
Chicago, Illinois

Submitted By:

Solutia Inc.
St. Louis, Missouri

Solutia, Inc.
St. Louis, Missouri

Sauget Area 1 EE/CA and RI/FS Support Sampling Plan Volume 1B

Human Health Risk Assessment Workplan, Sauget Area 1, Sauget and Cahokia, Illinois

ENSR Corporation
June 25, 1999
Document Number 6105-002-100b, 549432CP.DOC

CONTENTS

CONTENTS (Cont'd)

CONTENTS (Cont'd)

APPENDICES:

LIST OF TABLES

LIST OF FIGURES

LIST OF ACRONYMS

AAF	Absorption Adjustment Factors
ACGIH	American Conference of Governmental Industrial Hygienists
AOC	Administrative Order by Consent
ASTM	American Society for Testing and Materials
ATSDR	Agency for Toxic Substances and Disease Registry
AWQC	Ambient Water Quality Criteria
bgs	below ground surface
CADD	Chronic Average Daily Dose
CAS	Chemical Abstracts Service
COC	Constituents of Concern
COPC	Constituents of Potential Concern
CS	Creek Segment
CSF	Cancer Slope Factor
CSM	Conceptual Site Model
DQL	Data Quality Levels
EE/CA	Engineering Evaluation and Cost Analysis
EFH	Exposure Factors Handbook
ELCR	Excess Lifetime Cancer Risk
HEAST	Health Effects Assessment Summary Tables
HHRA	Human Health Risk Assessment
HI	Hazard Index
HQ	Hazard Quotient
IEPA	Illinois Environmental Protection Agency
IRIS	Integrated Risk Information System
LADD	Lifetime Average Daily Dose
MLE	Most Likely Exposure
MRL	Minimum Risk Level
NCEA	National Center for Environmental Assessment
NCP	National Contingency Plan
NIOSH	National Institute of Occupational Safety and Health
NOAA	National Oceanographic and Atmospheric Administration
OSHA	Occupational Safety and Health Administration
PCB	Polychlorinated Biphenyls
PQL	Practical Quantitation Limit
PRG	Preliminary Remediation Goal
QAPP	Quality Assurance Project Plan
RAGS	Risk Assessment Guidance for Superfund
RBC	Risk-Based Concentration

LIST OF ACRONYMS

RfC	Reference Concentration
RfD	Reference Dose
RG	Remedial Goal
RI/FS	Remedial Investigation and Feasibility Study
RME	Reasonable Maximum Exposure
SOW	Scope of Work
SSL	Soil Screening Level
SSP	Support Sampling Plan
SVOC	Semi-Volatile Organic Compounds
TACO	Tiered Approach to Corrective Action Objectives
TCDD	Tetrachlorodibenzo-p-dioxin
TEF	Toxic Equivalence Factor
TEQ	Toxic Equivalence Concentration
TPH	Total Petroleum Hydrocarbons
UCL	Upper Confidence Limit
USEPA	U.S. Environmental Protection Agency
VOC	Volatile Organic Compounds
WHO	World Health Organization

1.0 INTRODUCTION

This document presents a workplan for conducting a streamlined evaluation of short-term exposures, as well as for performing a baseline human health risk assessment (HHRA) for Sauget Area 1 located in Sauget and Cahokia, IL. This workplan has been developed to support the Engineering Evaluation and Cost Analysis (EE/CA) for the Sauget Area 1 source areas and potentially impacted portions of Area 1, and for the Remedial Investigation and Feasibility Study (RI/FS) for Sauget Area 1 groundwater. In addition, this workplan has been developed to satisfy the Scope of Work (SOW) for the EE/CA and RI/FS, provided as an attachment to the Administrative Order by Consent (AOC) entered into by the U.S. Environmental Protection Agency (USEPA) and Solutia Inc. (Solutia), as well as to be compliant with the National Contingency Plan (NCP).

Streamlined Short-Term Risk Assessment

In some situations, short-term exposures (e.g., subchronic daily intakes) may be important. An evaluation of short-term exposures is not normally included as part of the baseline risk assessment. However, since an EE/CA is being performed, an evaluation of the potential for unacceptable health risks after short-term exposures will be conducted. If an identified release is predicted to pose unacceptable health risks after short-term exposure, accelerated response actions to address any potential imminent and substantial endangerment to human health or the environment (i.e., principal threats) may be warranted. According to USEPA (1989a) guidance, the following factors should be considered when deciding whether to evaluate short-term exposures for the purposes of addressing the need for time-critical removal actions:

- The toxicological characteristics of the chemicals of potential concern;
- The occurrence of high chemical concentrations or the potential for a large release;
- Persistence of the chemicals in the environment; and
- The characteristics of the population that influence the duration of exposure.

The above factors will be evaluated and discussed in the EE/CA report. Additionally, if the average concentration of any constituent detected during the investigations exceeds the screening level for that constituent by greater than 100-fold (MADEP, 1995), a short-term exposure scenario evaluation will be performed for that constituent. Since this type of short-term health evaluation is not a standard component of most hazardous waste site health evaluations, limited guidance exists for performing these types of evaluations. Short-term exposures generally pose less of a health risk than longer-term exposures to the same concentration of a chemical. In recognition of this fact, USEPA generally establishes subchronic toxicity criteria at ten fold higher concentrations than chronic toxicity criteria. When available, USEPA-approved acute and subchronic toxicity criteria will be used to evaluate short-term exposures. Both reasonable maximum exposure (RME) and most likely exposure (MLE) scenarios will be included in the evaluation, utilizing upper bound and average media concentrations, respectively.

In the absence of USEPA criteria, short-term air exposures will be evaluated based on guidance provided by USEPA (1993c). As outlined by USEPA (1993c), the primary reference source for obtaining short-term air action levels will be the most recent version of the Texas Air Control Board Effects Screening Level List. Secondary sources of information will include, but will not be limited to, short-term exposure limits derived by the American Conference of Governmental Industrial Hygienists (ACGIH), the National Institute for Occupational Safety and Health (NIOSH), and the Occupational Safety and Health Administration (OSHA).

For soils, acute and intermediate duration minimal risk levels (MRLs) available from ATSDR will be used. If MRLs for soil are not available for a chemical evaluated for potential short-term health effects, acute and/or intermediate exposure duration health criteria will be derived by qualified toxicologists, for review by USEPA Region V and/or IEPA. A condition of imminent endangerment will be considered to exist if target risks exceed 10^{-4} or a hazard index for chemicals with similar target endpoints exceeds 1. Due to the need for time-critical removal actions when an imminent endangerment is identified, USEPA and IEPA will be notified within 30 days if any potential short-term health hazards are identified during the course of the investigations.

Baseline Risk Assessment

The HHRA will follow Task 4, Section 2.5, and Task 5, Section 2 of the SOW. In addition, the HHRA will also comply with USEPA guidance for conducting a risk assessment including, but not limited to, the following:

- Risk Assessment Guidance for Superfund (RAGS): Volume 1 - Human Health Evaluation Manual (Parts A and D) (USEPA, 1989a and 1998a).

- USEPA Soil Screening Guidance: Technical Background Document (USEPA, 1996a).

- Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. (USEPA, 1991a).

- Exposure Factors Handbook (USEPA, 1997a).

- Land Use in CERCLA Remedy Selection Process (USEPA, 1995).

The baseline risk assessment will evaluate potential health effects after chronic daily exposures and will be conducted using the four step paradigm as identified by the USEPA (USEPA, 1989a). The steps are:

- Data Evaluation and Hazard Identification
- Toxicity Assessment
- Exposure Assessment
- Risk Characterization

This workplan is organized into the following sections:

- Site Characterization – Section 2.0 of this workplan discusses the site and its environs, and presents a conceptual site model describing source areas, potential migration pathways, and potentially impacted media.

- Hazard Identification – Section 3.0 of this workplan presents a discussion of how site data will be summarized, and a description of the process for the selection of constituents of potential concern (COPC) to be evaluated quantitatively in the risk assessment.

- Dose-Response Assessment – Section 4.0 of this workplan presents a discussion of the dose-response assessment process. The dose-response assessment evaluates the relationship between the magnitude of exposure (dose) and the potential for occurrence of specific health effects (response) for each COPC. Both potential carcinogenic and noncarcinogenic effects will be considered. The most current USEPA verified dose-response values will be used when available.

- Exposure Assessment - Section 5.0 of this workplan presents a discussion of the exposure assessment process. The purpose of the exposure assessment is to provide a quantitative estimate of the magnitude and frequency of potential exposure to COPC by a receptor. Potentially exposed individuals, and the pathways through which those individuals may be exposed to COPC are identified based on the physical characteristics of the site, as well as the current and reasonably foreseeable future uses of the site and surrounding area. The extent of a receptor's exposure is estimated by constructing exposure scenarios that describe the potential pathways of exposure to COPC and the activities and behaviors of individuals that might lead to contact with COPC in the environment.

- Risk Characterization – Section 6.0 of this workplan presents a discussion of the risk characterization process and uncertainties associated with the risk assessment process. Risk characterization combines the results of the exposure assessment and the toxicity assessment to derive site-specific estimates of potentially carcinogenic and noncarcinogenic risks resulting from both current and reasonably foreseeable potential human exposures to COPC. The results of the risk characterization will be used to identify constituents of concern (COC), which are the subset of those COPC whose risks result in an exceedance of the target risk range of 10^{-6} to 10^{-4} for potential carcinogens and a target Hazard Index of 1 for noncarcinogens (that act on the same target organ), as defined in the AOC SOW and by the Illinois Environmental Protection Agency (IEPA) (1998).

Within any of the steps of the risk assessment process described above, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. The assumptions that introduce the greatest amount of uncertainty in this risk evaluation will be discussed in Section 6.0 of the HHRA report.

- Summary and Conclusions – Section 7.0 of this workplan will discuss how the results of the HHRA will be summarized in the final report.

Each of these steps is discussed in the sections that follow. References are provided in Section 8.0 of this workplan. The sections of the HHRA report submitted as part of the EE/CA and RI/FS will be organized following this same format.

2.0 SITE CHARACTERIZATION

This workplan addresses the areas of Sauget Area 1 as identified in the AOC. Specifically, the EE/CA for Sauget Area 1 will address the following areas:

- Fill areas (Sites G, H, I, L, M, and N), and
- Potentially impacted areas:
  - Dead Creek Segments (CS): CS-B, CS-C, CS-D, CS-E, and CS-F
  - Commercial, residential and/or undeveloped properties adjacent to these creek segments

The RI/FS for Sauget Area 1 will address groundwater in the following areas:

- Fill areas and areas downgradient of the source areas
- *Groundwater in the area of, and private wells identified along,* Walnut Street and Judith Lane in Cahokia, IL

To guide identification of appropriate exposure pathways for evaluation in the risk assessment, a conceptual site model (CSM) for human health has been developed. The purpose of the CSM is to identify fill areas, potential migration pathways of constituents from fill areas to media where exposure can occur, and to identify potential human receptors. Potential exposure pathways and potential receptors are discussed in Section 5.0.

Conceptual Site Model

At Sauget Area 1, the fill areas are identified as Sites G, H, I, L, M, and N. Constituents in the fill areas may leach to underlying groundwater. Volatile organic compounds (VOCs) in groundwater may volatilize into outdoor air and may infiltrate into air in overlying buildings. Constituents in groundwater may discharge to Dead Creek and subsequently be transported downstream to the lower reaches of Dead Creek and into the Borrow Pit Lake. Fish in the Borrow Pit Lake may have accumulated constituents present in surface water and/or sediments. In addition, it is possible that Dead Creek flooding events and/or windblown dust may have resulted in the distribution of constituents to soils on the properties adjacent to the creek. Figure 2-1 presents a CSM for Sauget Area 1. The CSM identifies sources, environmental release mechanisms, potential exposure pathways, potential exposure routes, and potential human receptors. Those potentially complete exposure pathways to be considered for further evaluation in the risk assessment are identified. Receptors and pathways are discussed in more detail in Section 5.0.

The Support Sampling Plan (SSP) sampling program has been developed to address these potential migration pathways. Sampling to be conducted in support of the HHRA include the following. Fill area surface soil and wastes will be sampled and characterized. Groundwater in the source areas, downgradient of the source areas, and southwest of the source areas will be sampled and characterized. Shallow groundwater and domestic wells in the vicinity of Walnut Street and Judith Lane will also be characterized. Surface and subsurface soils in the undeveloped and residential areas of the residential/commercial/undeveloped properties adjacent to Dead Creek will be sampled. Surface water and sediments in Dead Creek and the Borrow Pit Lake will be sampled. In addition, fish tissue samples from the Borrow Pit Lake will be analyzed.

The CSM is meant to be a "living" model that can be updated and modified as additional data become available. The exposure scenarios proposed for quantitative evaluation in the risk assessment (see Section 5.0) have been identified based on this current CSM. However, the CSM will be reviewed and modified as necessary once the analytical data from the SSP program have become available. Any substantial changes in the CSM and, subsequently, the pathways for quantitative evaluation, will be discussed with USEPA prior to conduct of the risk assessment.

3.0 HAZARD IDENTIFICATION

The purpose of the hazard identification process is two-fold: 1) to evaluate the nature and extent of release of constituents present at the site; and 2) to select a subset of constituents of potential concern (COPC) for quantitative evaluation in the risk assessment. This step of the risk assessment will involve compiling and summarizing SSP data for the risk assessment, and selecting COPC based on a series of screening criteria.

3.1 Data Compilation

For Sauget Area 1, existing data are available from previously conducted investigations. New data will be available from the field activities specified in the SSP. The HHRA will include a section that compiles all of the valid data collected from the site in support of the SSP.

3.1.1 Areas and Media

The SSP for Sauget Area 1 is designed to investigate the source areas, Dead Creek and its environs, and the residential/commercial/undeveloped areas adjacent to Dead Creek. Of the data to be collected for the SSP, analytical data for use in the HHRA will be available for the following media:

- Source area shallow groundwater;
- Source area downgradient alluvial groundwater;
- Shallow groundwater southwest of source areas;
- Shallow groundwater in the vicinity of Walnut Street and Judith Lane;
- Groundwater from private wells in the vicinity of Walnut Street and Judith Lane;
- Source area surface soil;
- Source area subsurface waste;
- Residential area surface soil (0-0.5 feet below ground surface (bgs));
- Residential area subsurface soil (0.5-6 feet bgs);
- Dead Creek sediment;
- Borrow Pit Lake sediment;
- Dead Creek surface water;
- Borrow Pit Lake surface water;
- Fish tissue from Borrow Pit Lake (if populations are present); and
- 24-hour air samples at Sites G, H, I, and L.

Analytical data for use in the HHRA from background or reference locations will be available for the following media:

- Surface soil;

- Subsurface soil;
- Groundwater;
- Surface water;
- Sediment;
- Fish tissue; and
- Upwind air.

3.1.2 Analytes

The SSP identifies the suites of analytes for each medium. For ease of discussion here, the analytes to be included in the risk evaluation are identified as follows:

- Full suite of analytes – VOCs, semi-volatile organic compounds (SVOCs), metals, mercury, cyanide, polychlorinated biphenyls (PCBs), pesticides, and herbicides;
- Dioxins – dioxins and furans; and
- Industry-specific analytes – PCBs, total petroleum hydrocarbons (TPH), copper, zinc, fluorides, phosphorous and ortho-phosphate. [Note - only PCBs, copper, zinc, fluorides, and phosphorous will be quantitatively evaluated in the HHRA. Fluorides, phosphorous, and ortho-phosphate will be analyzed for only in surface water.]

All analytical data collected in support of the SSP will be compiled and tabulated in a database for statistical analysis. Summary statistics tables will be developed for each medium in each area, and will present for each constituent the minimum and maximum detected values, the arithmetic mean, the 95th percentile upper confidence limit (UCL) on the arithmetic mean (USEPA, 1992a), and the frequency of detection. Constituents analyzed for but never detected in a particular medium will not be included in the summary statistics for that medium. For constituents detected at least once in a particular medium, samples reported as "non-detect" by the laboratory will be assigned a value of one-half the sample quantitation limit in calculating summary statistics (USEPA, 1989a; IEPA, 1998). Duplicate sample results will be averaged and treated as a single sample result when compiling summary statistics.

3.1.3 Sample Collection by Area and Medium

Data sets for each medium are described below. Sample collection strategy based on human health risk assessment needs is discussed in conjunction with the potential exposure scenarios in Section 5.2.

3.1.3.1 Groundwater

Fill Areas - Data for shallow groundwater samples from wells located in the fill areas, the downgradient alluvial aquifers, and shallow groundwater southwest of the fill areas, as identified in the SSP, will be evaluated in the risk assessment. These data will include the full suite of analytes and dioxins.

Residential Area - Analytical data for shallow groundwater in the Walnut Street/Judith Lane residential area, as well as for four domestic wells in this area will be evaluated in the risk assessment. These data will include the full suite of analytes and dioxins.

3.1.3.2 Fill Area Wastes

Sediment samples will be collected from Site M and analyzed for the full suite of analytes and dioxins. Subsurface waste samples will be collected from Sites G, H, I, L, and N and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment. As described in Section 5.2, the VOC sample will be a discrete sample taken along the depth of the waste at the location having the highest PID/FID (Photo/flame Ionization Detector) reading. The remaining analyses will be conducted on a sample composited from material collected throughout the depth of the waste (note - non-waste materials will not be included in this composite). Composting is being conducted to ensure that the sample collected is representative of all the wastes, not just a single stratum within the wastes. Composite samples are not generally regarded as the best descriptor with which to calculate the upper bound concentrations for a data set (USEPA, 1989a). In this case, because the sample is collected from waste materials only, the detected analytes are more likely to be representative of the heterogeneity of the wastes than those from a single sample collected at a discrete location within the wastes.

3.1.3.3 Soil

Fill area - Surface soil (0-0.5 feet bgs) samples will be collected, colocated with the fill area waste sampling locations. These samples will be analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment.

Residential/Commercial/Undeveloped Area - Surface (0-0.5 feet bgs) and subsurface (0.5-6 feet bgs) soil samples will be collected from undeveloped areas along seven transects as identified in the SSP in the residential/commercial/undeveloped area adjacent to Dead Creek and analyzed for the full suite of analytes and dioxins. Based on the transect analytical results, surface and subsurface soil samples will be collected from three residences along each of Transects 1 through 6 and two residences along Transect 7 and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment.

3.1.3.4 Surface Water

Surface water samples will be collected from Dead Creek and Borrow Pit Lake, and analyzed for the full suite of analytes and dioxins. These data will be used in the risk assessment. Dead Creek and Borrow Pit Lake will be evaluated separately in the risk assessment. Depending on the distribution of analytical results, the sections of Dead Creek may be evaluated separately or in combination in the risk assessment.

3.1.3.5 Sediment

Sediment samples will be collected from Dead Creek and Borrow Pit Lake. Data for the full suite of analytes and dioxins will be available for approximately 20 percent of these samples, and data for the industry-specific analytes will be available for approximately 80 percent of these samples. Depending on the distribution of analytical results, the sections of Dead Creek may be evaluated separately or in combination in the risk assessment.

3.1.3.6 Fish Tissue

Fish tissue samples will be collected from Borrow Pit Lake and analyzed for the full suite of analytes (with the exception of VOCs) and dioxins. The determination of the applicability of the fish ingestion pathway for this waterbody is discussed in the Exposure Assessment (Section 5.3.5). If the fish ingestion pathway is included for quantitative evaluation in the HHRA, whole fish data will be used. Sample compositing will occur only where necessary to achieve a sufficient sample size for analysis. Predator, bottom feeding and forage fish will be collected as available. Expected types to be encountered include bass, crappie, catfish and/or bluegill.

3.1.3.7 Air

Air samples will be collected in the vicinity of Sites G, H, I, and L and analyzed for VOCs, SVOCs, PCBs, dioxin, and metals. Because these are 24-hour air samples collected at a single time point, they will not be used in the calculation of risks in the HHRA. However, the data will be compared to chronic and, if appropriate, to subchronic or acute criteria as discussed in Section 1.0. Initial comparison will be made to USEPA Region 9 Preliminary Remediation Goals for air (USEPA, 1998c).

3.2 Selection of Constituents of Potential Concern

COPCs are a subset of the complete list of constituents detected in site media that are carried through the quantitative risk assessment process. Selection of COPCs focuses the analysis on the most likely risk "drivers." As stated in USEPA guidance (USEPA, 1993a):

"Most risk assessments are dominated by a few compounds and a few routes of exposure. Inclusion of all detected compounds at a site in the risk assessment has minimal influence on the total risk. Moreover, quantitative risk calculations using data from environmental media that may contain compounds present at concentrations too low to adversely affect public health have no effect on the overall risk estimate for the site. The use of a toxicity screen allows the risk assessment to focus on the compounds and media that may make significant contributions to overall risk."

Several factors are typically considered in selecting COPCs for a site, including natural background, frequency of detection, and toxicity, including essential nutrient status. Risk calculations will be conducted using the COPCs identified in this step.

Constituents of concern (COC) will be identified in Section 6.0 of the HHRA as those constituents whose risks result in an exceedance of the target risk range of 10^{-6} to 10^{-4} for potential carcinogens and a target Hazard Index of 1 for noncarcinogens (that act on the same target organ), as defined in the AOC SOW and by IEPA (1998). Remedial goals will be developed for COCs based on the exposure pathways evaluated in the risk assessment.

The steps to be used to identify COPC are presented below.

3.2.1 Evaluation of Frequency of Detection and Essential Nutrient Status

A frequency of detection screen will be conducted on each medium (e.g., sediment, surface soil, etc.). Constituents that are detected in fewer than 5% of samples, provided 20 samples are available, will not be included as COPCs. However, some of these constituents may be retained as COPC based on professional judgment, considering factors such as the presence of a hotspot. In addition to the frequency of detection screen, essential nutrients (i.e., calcium, iron, magnesium, sodium and potassium) will not be included as COPCs (USEPA, 1989a).

3.2.2 Comparison to Background

Background samples to be collected in the vicinity of the site present information on naturally-occurring levels of constituents typical for the local area. The purpose of comparing site conditions to local background is to determine if site concentrations of constituents are representative of background concentrations, which, therefore, should not be included in risk calculations. Background comparisons will be conducted for each medium using site-specific background data and background concentrations for rural and urban areas of Illinois published by IEPA (1998).

Groundwater, surface water and sediment samples collected in upgradient locations, if available, will provide site-specific background data for these media. Soil samples collected at appropriate off-site locations, as described in the SSP, will provide site-specific background data for the soil media. See SSP Sections 6.8, 7.6, and 11.4 for a discussion of background locations.

The procedure for determining whether a constituent concentration is consistent with background will follow that developed by USEPA Region 4 (USEPA, 1996b). Maximum detected concentrations of constituents in environmental media at the site will be compared against two times the arithmetic mean site-specific background concentration. USEPA Region 4 states that although RAGS (USEPA, 1989a) allows the use of statistics in data evaluation, statistics may not be sufficiently conservative at this stage of the risk evaluation; and in most cases, there are not a sufficient number of samples for conducting a statistical analysis. Therefore, if maximum concentrations of inorganic constituents in an area are found to be less than two times the average background concentrations, then those constituents can be eliminated from quantitative evaluation in the risk assessment. Constituents whose concentrations are found to be above typical local background levels will be retained for evaluation in the next step of the hazard identification process (Toxicity Screen).

3.2.3 Toxicity Screen

A toxicity screen will be performed in accordance with USEPA Region 5 guidance (USEPA, 1998b) and IEPA regulations (IEPA, 1998). USEPA Region 5 guidance identifies the following three sources as appropriate screening levels for soil, in order of preference:

1) Most recent generic soil screening levels (SSLs) developed and presented in Appendix A of the Soil Screening Guidance (USEPA, 1996a). The SSLs are based on ingestion and inhalation (direct contact) and soil-to-groundwater exposure pathways for a residential scenario.

2) Site-specific SSLs derived using the methodology outlined in the above reference.

3) Most recent USEPA Region 9 Preliminary Remediation Goals (PRGs; USEPA, 1998c).

The IEPA Tiered Approach to Corrective Action (TACO) (IEPA, 1998) is very similar to that outlined in the SSL guidance (USEPA, 1996a) in that it provides Tier I criteria based on direct contact (ingestion and inhalation) and the soil-to-groundwater pathway. In fact, the TACO Tier I criteria have been developed based on the USEPA SSL guidance. However, the TACO Tier I criteria are more comprehensive because values are provided for a longer list of constituents, and Tier I criteria are available for both residential and industrial scenarios.

Therefore, IEPA TACO Tier I criteria will be used for the identification of COPC for soil and groundwater for quantitative evaluation in the risk assessment. Where IEPA TACO Tier I criteria (IEPA, 1998) are not available, USEPA Region 9 PRGs (1998c) will be used. Residential values will be used to identify COPC for residential soils and sediments and all groundwater, and industrial values will be used to evaluate source area soils and waste.

Following IEPA guidance, the criteria for groundwater will be adjusted for cumulative effects for both potential carcinogens and noncarcinogens. Per the TACO program guidance, Tier I criteria for soils are not adjusted for cumulative effects (IEPA, 1998).

IEPA TACO Tier I values are not available for surface water, fish tissue, or air. Hence, surface water data will be compared with the lower of screening values identified for groundwater and the promulgated human health Ambient Water Quality Criteria (AWQCs) for fish ingestion (USEPA, 1998d). Fish tissue data will be compared to the USEPA Region 3 Risk-Based Concentrations (RBCs) for fish (USEPA, 1998e). Modeled air concentrations will be compared to USEPA Region 9 PRGs (USEPA, 1998c).

These criteria were used to develop data quality levels (DQLs) to be used to identify appropriate practical quantitation limits (PQLs) for laboratory methods for the analytical program. The DQLs and PQLs are discussed in greater detail in the Quality Assurance Project Plans (QAPPs) for the site (see Volumes 2B and 3B of the SSP). The DQLs for the HHRA are presented in Appendix A.

Per USEPA request, the current TACO Tier I values are presented in Appendix B, the current USEPA Region 9 PRGs are presented in Appendix C, the current USEPA Region 3 RBCs are presented in Appendix D, and the current AWQCs are presented in Appendix E. The PRGs and RBCs are periodically updated by USEPA. The most current criteria available will be used in the selection of COPC.

Constituents with maximum concentrations less than or equal to the screening criteria will not be included as COPC. If no COPC are identified for a medium, that medium will not be evaluated quantitatively in the HHRA.

Tables presenting the results of each screening step will be presented in the risk assessment report. The final list of COPC for inclusion in the risk assessment will also be presented in the risk assessment and included in all subsequent risk calculations.

4.0 DOSE-RESPONSE ASSESSMENT

The purpose of the dose-response assessment is to identify the types of adverse health effects a constituent may potentially cause, and to define the relationship between the dose of a constituent and the likelihood or magnitude of an adverse effect (response).

Adverse effects are defined by USEPA as potentially carcinogenic or noncarcinogenic (i.e., potential effects other than cancer). Dose-response relationships are defined by USEPA. The dose-response values for potentially carcinogenic effects are termed Cancer Slope Factors (CSFs) or Unit Risk Factors, and dose-response values for noncarcinogenic effects are termed Reference Doses (RfDs) or Reference Concentrations (RfCs). These values are available from USEPA sources, such as USEPA's Integrated Risk Information System (IRIS), an on-line computer database (USEPA, 1999), and the Health Effects Assessment Summary Tables (HEAST) (USEPA, 1997b). Both sets of potential health effects will be evaluated in the risk assessment. The USEPA National Center for Environmental Assessment (NCEA) will be consulted if a constituent does not have a dose-response value in either IRIS or HEAST. Appropriate criteria may also be derived by qualified toxicologists using current USEPA-approved methodologies.

Dose-response values used in the risk assessment will be presented in tabular format. For each constituent the table will present the Chemical Abstracts Service (CAS) number, dose-response value, source, study animal, study method, and where appropriate, target organ, critical effect, uncertainty factors, and confidence level.

Dose-response values are available for inhalation and oral exposures. Oral dose-response values will be used to evaluate dermal exposures, provided appropriate dermal absorption values are available. COPC will be evaluated quantitatively for the dermal exposure pathway. For inhalation pathways, reference concentrations (in units of mg/m^3) will be converted to reference doses (in units of mg/kg-day) for calculating risk for systemic toxicants. For direct acting toxicants, the oral, dermal, and inhalation pathways will be evaluated separately.

4.1 PCB Dose-Response

Risks from potential exposures to PCBs will be calculated using the most current guidance available from USEPA. Currently, USEPA-approved guidance is provided in IRIS (USEPA, 1999). Total PCB concentrations will be calculated by summing the separate homolog concentrations. The total PCB concentrations will be multiplied by the verified cancer slope factors listed in IRIS (USEPA, 1999). Guidance provided in IRIS specifies three tiers of human slope factors for environmental PCBs: high risk and persistence, low risk and persistence, and lowest risk and persistence. The choice of slope factors for use depends on the medium of exposure and PCB chlorine content, as outlined in IRIS

(USEPA, 1999). Thus, a slightly differing approach to calculating potential cancer risks will be taken for different media.

Non-cancer risks from potential exposures to PCBs will be calculated using the most conservative RfD for a PCB mixture. In addition, uncertainty surrounding the use of USEPA-verified toxicity criteria will be discussed.

4.2 Dioxin Dose-Response

The potential carcinogenic effects associated with exposure to dioxin and furan congeners in environmental media will be assessed in accordance with the approach developed by USEPA (1989b). Risks will be calculated for 2,3,7,8-TCDD and the dioxin and furan congeners using the cancer slope factor for 2,3,7,8-TCDD listed in HEAST and using the TEFs provided in USEPA (1989b). The TEFs are fractions that equate the potential toxicity of each congener to that of 2,3,7,8-TCDD. The World Health Organization (WHO) (Van den Berg et al., 1998) has assigned a TEF to each of the dioxin and furan congeners that slightly differ from the USEPA-approved values. The TEFs provided by USEPA (1989b) and proposed by Van den Berg et al. (1998) are listed in Table 4-1. The exposure point concentration for each dioxin and furan congener will be multiplied by its TEF, resulting in a TCDD toxic equivalence concentration (TCDD-TEQ). The TCDD-TEQ values for each of the congeners will then be added together. The cancer slope factor for 2,3,7,8-TCDD will then be used to calculate potential carcinogenic risks resulting from potential exposure to 2,3,7,8-TCDD, and the dioxin and furan congeners.

5.0 EXPOSURE ASSESSMENT

The purpose of the exposure assessment is to predict the magnitude and frequency of potential human exposure to each of the COPC retained for quantitative evaluation in the HHRA. The first step in the exposure assessment process is the characterization of the setting of the site and surrounding area. Current and potential future site uses and potential receptors (i.e., people who may contact the impacted environmental media of interest) are then identified. Potential exposure scenarios appropriate to current and potential future site uses and receptors are then developed. Those potential exposure pathways for which COPC are identified and are judged to be complete will be evaluated quantitatively in the risk assessment. Reasonable maximum exposure (RME) assumptions, and most likely exposure (MLE) assumptions based on appropriate USEPA guidance, will be employed in the quantitative risk assessment.

5.1 Identification of Potential Exposure Scenarios

Exposure scenarios are developed on the basis of the CSM for a site. The CSM for Sauget Area 1 was presented in Section 2.0 (Figure 2-1). The CSM was used to develop the potential exposure scenarios identified below and in Table 5-1. Table 5-1 provides a more detailed presentation of receptors and pathways by exposure area to be evaluated in the risk assessment.

Sauget Area 1 fill areas have been used for industrial purposes for many years (since the 1930s or earlier) and use of these areas is expected to remain industrial. The fill areas within Sauget Area 1 are zoned commercial/industrial and it is likely that the fill areas will continue to be used well into the reasonably foreseeable future for commercial/industrial purposes.

As discussed in Sections 1.0 and 2.0 of the SSP, Sites G, H, I, L, M and N contain wastes that came from a wide variety of municipal and industrial sources. Site M is a fenced former sand borrow pit that is now filled with water and is hydrologically connected to Dead Creek. Site G is a fill area stabilized by USEPA in an emergency response that solidified organic wastes, placed a temporary soil cover over the site, and controlled site access by the installation of a fence. Recent inspection indicates that the site and fence are still stable. Recent inspection of Site H indicated that the site is stable with a vegetative cover and no exposed wastes at the surface. Site L also appears to be stable. It is covered with cinders and is located in a vegetated field. Site N reportedly contains construction rubble. Site I was originally used as a sand and gravel pit that received industrial and municipal wastes. The site is currently graded and covered with crushed stone and used for equipment and truck parking.

Because these source areas are generally covered and stable with no evidence of exposed wastes at the surface, sampling in these areas is focused on collection of waste samples. Although wastes are not present at the surface, surface soil sampling will also be conducted.

An on-site outdoor industrial worker and a trespassing teen will be evaluated for potential exposure to COPC where identified in surface soil, and to COPC that may volatilize into outdoor air from underlying groundwater and wastes.

Because the wastes are at depth, a construction/utility worker will be evaluated for potential exposure to constituents in the waste. Construction/utility work is assumed to occur only up to depths of 12 to 15 feet bgs, however, to be conservative, analytical data from waste samples composited throughout the depth of the fill material will be used in the risk assessment (see discussion in Section 3.1.3.2). Due to the shallow depth of groundwater, the construction/utility worker may contact groundwater during excavation.

Due to the presence of a plume of VOCs in groundwater in the source areas and wastes present in the subsurface, an on-site indoor industrial worker will be evaluated for potential exposure to COPC via inhalation of volatile constituents present in indoor air due to vapor intrusion from groundwater and/or wastes. Analytical data collected from shallow groundwater from the existing wells at the sites and analytical data from subsurface waste samples will be used in the risk assessment. If VOCs are detected in shallow groundwater in other groundwater areas of the site, an indoor industrial worker receptor will be evaluated.

Dead Creek bisects Sauget Area 1, passing through areas of commercial land use, areas of open land, and areas of residential land use, and eventually discharges to Borrow Pit Lake and Prairie DuPont Creek. As such, Dead Creek serves as a potential migration pathway for COPC from the impacted fill areas. It is possible that windblown dust or periods of overbank flow (i.e., flooding) have resulted in the deposition of site-related COPC on soil of the adjacent residential/commercial/undeveloped areas. Therefore, it is possible that residents in the vicinity of Dead Creek may be exposed to site-related COPC in soil. Recent inspection indicates that some residences have vegetable gardens. Site-related COPC may be taken up by plant material and subsequently ingested. If VOCs are present in shallow groundwater and/or subsurface soils in these areas, they may infiltrate into indoor air and outdoor air. If these are complete exposure pathways, they will be evaluated in the HHRA.

In addition, a construction/utility worker may contact COPC in surface and subsurface soil and shallow groundwater in the residential/commercial/undeveloped area. The major potential COPC migration pathway is overbank flow. Due to this migration pathway, COPC are expected to occur at the surface. If COPC are located at depth in this area, it would be due to infiltration from the surface. Such infiltration is not expected to move COPC to great depths; thus, the purpose for collecting subsurface soils in the 0.5-6 foot interval. Although construction and utility work may proceed to depths of 12 to 15 bgs, COPC concentrations in the 0.5 to 6 foot interval are expected to be higher than for deeper intervals. Therefore, these data will be used to evaluate potential exposure to COPC in subsurface soil, which will provide a conservative estimate of risk for this pathway.

An indoor industrial or commercial worker in the residential/commercial/undeveloped area may be exposed to COPC in indoor air via inhalation due to volatilization of COPC from underlying soil and/or groundwater in this area. Similarly, an outdoor industrial or commercial worker may be exposed to COPC in surface soil via incidental ingestion, dermal contact and inhalation of volatiles and particulates. Inhalation of COPC volatilizing from groundwater and/or subsurface soil may also occur.

As access to Dead Creek is generally uncontrolled, it is possible that recreational receptors (i.e., trespassing children/teenagers) could be exposed to COPC in surface water and sediment of Dead Creek and Site M while wading. Although access to Borrow Pit Lake is uncontrolled, it is located on private property, and access is very difficult due to its setting. However, recreational teenagers could be exposed to COPC in surface water and sediment of Borrow Pit Lake while wading or swimming. Again, although access is difficult, recreational fishing may occur in Borrow Pit Lake.

Groundwater is not used as a source of drinking water in the area. However, there are some private wells in the area that may be used for outdoor household activities. Therefore, residents may be exposed to COPC in groundwater in these areas via incidental ingestion and dermal contact. If it is determined that groundwater is being used as a sole source of drinking water for any of the residences downgradient of the fill areas, a drinking water scenario will be added to the HHRA.

Final receptor selection will be made once site analytical data have been evaluated and COPCs identified. If no COPCs are identified in a particular medium (e.g., fish), and/or the potential exposure pathway, upon further investigation, is judged to be incomplete (e.g., recreational fishing), then the exposure scenarios associated with that medium/pathway will not be quantitatively evaluated in the HHRA. The potential receptors and their associated exposure scenarios are discussed below and summarized in Table 5-1.

5.2 Sample Collection Strategy

Table 5-2 presents a summary of the sampling strategy for each environmental medium and identifies the number of samples to be collected. In addition, the exposure areas, receptor(s) and potential exposure route(s) to be evaluated using the data are identified, based on the CSM developed for the site (see Figure 2-1, and Table 5-1). Sample collection in residential areas has been focused on areas adjacent to Dead Creek upstream of Route 3, as these areas are closer to the fill areas than those downstream of Route 3.

5.3 Receptor Identification

The following subsections discuss the parameters that will be used to evaluate each of the potential receptors in the HHRA. Both RME and MLE scenarios will be evaluated for each receptor. Exposure factors common to several of the receptors are discussed in Section 5.4.

5.3.1 Indoor Industrial Worker

Exposure assumptions for the indoor industrial worker under the RME and MLE scenarios are shown in Table 5-3. Given the relatively shallow depth of groundwater, it is possible an indoor industrial worker may be exposed indirectly to groundwater via inhalation of volatile COPC migrating from groundwater and the subsurface to indoor air of an industrial/commercial building. The indoor industrial worker receptor will be evaluated for the fill areas and the residential/commercial/undeveloped areas of Sauget Area 1.

5.3.2 Outdoor Industrial Worker

Exposure assumptions for the outdoor industrial worker under the RME and MLE scenarios are shown in Table 5-4. The outdoor industrial worker may contact COPC in surface soil via incidental ingestion and dermal contact, and may inhale COPC via volatilization from the surface and subsurface and via particulate emissions from the surface.

5.3.3 Trespassing Teenager

Exposure assumptions for the trespassing teenager under the RME and MLE scenarios are shown in Table 5-5. It is assumed that this receptor can be exposed to COPC in surface soil in the fill areas via accidental ingestion, dermal contact, and inhalation of volatiles and particulates, and can be exposed to COPC in subsurface wastes and/or groundwater via inhalation of volatiles.

5.3.4 Construction/Utility Worker

Exposure assumptions for the construction/utility worker under the RME and MLE scenarios are shown in Table 5-6. Exposure media of interest in the evaluation of potential risk to a future construction/utility worker will potentially include surface soil, subsurface soil/wastes and groundwater. Exposure could occur via incidental ingestion of and dermal contact with soil/waste and shallow groundwater and via inhalation of fugitive dust and/or vapors from soil and groundwater. A construction/utility worker receptor will be evaluated for the fill areas and the residential/commercial/undeveloped areas of Sauget Area 1. The soil ingestion rate listed in Table 5-6 for the construction worker under the MLE scenario is discussed in Section 5.4.

5.3.5 Resident

Given the potential for migration of site-related COPC from the fill areas to a residential area, it is possible that a resident may be exposed to COPC in environmental media. The exposure media of interest are surface soil, subsurface soil, plant tissue, and groundwater. A resident may potentially be exposed directly to COPC in soil via incidental ingestion, dermal contact, and inhalation of volatiles and particulates. Indirect exposure to COPC in soil may occur and through ingestion of produce grown in impacted residential soil. Public water is provided to residential areas; however, some private wells exist. Residents could be exposed to COPC in groundwater in these areas via incidental ingestion and dermal contact during outdoor household use. In addition, if VOCs are present in groundwater and/or subsurface soil in this area, residents could be exposed via inhalation of vapors migrating to indoor air. Table 5-7 presents the exposure assumptions for evaluation of a child resident (0 to 6 yrs of age) and an adult resident under RME and MLE scenarios. Because several of the Dead Creek segments are adjacent to the residential areas under evaluation, the recreational teenager (below) and residential receptor risks will be evaluated both separately and in total, as indicated in Table 5-1. In addition, a future residential exposure scenario will be evaluated for areas M and N. Because area M is a lagoon, the future exposure pathway to be evaluated will be inhalation of sediment–derived dusts by residential receptors in transects 1 and 2, assuming the lagoon could be drained and dried in the future.

5.3.6 Recreational Teenager

It is assumed that an adolescent could access Dead Creek and Borrow Pit Lake surface water and sediment for recreational purposes. Therefore, it is possible that a receptor (aged 7 to 18 years) (referred to here as a recreational teenager for ease of discussion) could be exposed to COPC present in surface water and sediment of Dead Creek and Borrow Pit Lake while wading or swimming, respectively. Exposure assumptions for the recreational teenager under the RME and MLE scenarios are shown in Table 5-8.

5.3.7 Recreational Fisher

Recreational fishing may take place at Borrow Pit Lake. As Dead Creek may serve as a potential migration pathway for COPC from the source areas, fish in Borrow Pit Lake may contain COPC in their tissue. Therefore, a recreational fisher has the potential to be exposed to site-related COPC through ingestion of fish from Borrow Pit Lake. This receptor may also contact COPC in surface water and sediment while fishing. The exposure assumptions for the recreational fish ingestion pathway for the RME and MLE receptors are summarized in Table 5-9. To determine if this pathway is complete, two field surveys will be conducted. An ecological evaluation of the Borrow Pit Lake will be used to determine if it can sustain a recreational fishery. In addition, a creel survey will be conducted to determine if Borrow Pit Lake is fished and what fish may be caught.

5.4 Exposure Parameters

5.4.1 Soil Ingestion Rate – Adult Construction Worker

Incidental soil ingestion occurs at all ages as a result of hand-to-mouth activities. Currently, there are little or no reliable quantitative data available for estimating adult soil ingestion rates. USEPA risk assessment guidance suggests a soil ingestion rate of 100 mg/day for adults in a residential scenario (USEPA, 1989a, 1991a), and a soil ingestion rate of 50 mg/day for adults in an industrial scenario (USEPA, 1991a).

USEPA presented an estimate of a soil ingestion rate for adults doing yard work of 480 mg/day in their supporting evidence for the commercial/industrial soil ingestion rate of 50 mg/day in the "Standard Default Exposure Factors" Directive (USEPA, 1991a); the 480 mg/day value was not presented in the table of default exposure factors. The Agency states: "For certain outdoor activities in the commercial/industrial setting (e.g., construction or landscaping), a soil ingestion rate of 480 mg/day may be used; however, this type of work is usually short-term and is often dictated by the weather. Thus, exposure frequency would generally be less than one year and exposure duration would vary according to site-specific construction/maintenance plans." However, some regions and state agencies have stipulated the use of this value to evaluate a construction worker exposure scenario. The Hawley (1985) study, which is the basis for the soil ingestion rate of 480 mg/day, was recently reviewed by the USEPA (USEPA, 1997a), which stated that, "Given the lack of supporting measurements, these estimates must be considered conjectural."

In the Hawley (1985) study, the author assumed that soil adheres to the surface area of the hands at a loading of 3.5 mg/cm^2. This value was based on a layer of soil on skin assumed to be 0.005 cm deep, a soil density of 1.5 g/cm^2, and 50% void space. Using the author's derived soil-to-skin adherence loading of 3.5 mg/cm^2 and assuming that the amount of soil covering a fraction of the hands (approximately 70 cm^2) is ingested twice a day, Hawley calculated a soil ingestion rate of 480 mg/day.

Hawley's 1985 analysis was one of the first published health risk assessments and was performed before any of the quantitative fecal tracer soil ingestion studies for either children or adults were conducted (Calabrese et al., 1989; Davis et al., 1990; Clausing et al., 1987; Calabrese et al., 1990). Thus, the estimate of 480 mg/day predates all of our current knowledge about soil ingestion among both children and adults, as well as recent published data on soil-to-skin adherence rates.

In 1993, USEPA sponsored a workshop to evaluate soil-to-skin adherence data. As a result, a study to determine a more accurate characterization of soil-to-skin adherence was sponsored by the USEPA and conducted by John C. Kissel and associates at the University of Washington (Kissel et al., 1996; Holmes et al., 1998). The intent of this study was to resolve uncertainties and develop more accurate measures of soil-to-skin loading rates for individuals involved in various occupational and recreational activities. As reported in the Exposure Factors Handbook (EFH) (USEPA ,1997a), soil loading on skin surfaces as a result of various occupational and recreational activities was directly measured. This study indicates that soil loadings vary with the type of activity and the body parts contacted. As one would expect, adherence appears to be greatest during outdoor activities such as farming and gardening, and more soil/dust tends to adhere to the hands and knees than to other areas of the body.

Average hand soil loading factors are as presented in the EFH (USEPA, 1997a) for the adult outdoor workers evaluated by Kissel and Holmes. In every case, soil adherence during occupational exposure was measured to be considerably lower than Hawley's estimate of 3.5 mg/cm^2. The range of soil adherence loadings measured by Kissel and Holmes falls within the USEPA range of 0.2 to 1.0 mg/cm^2 (USEPA, 1992b).

For this evaluation, the construction worker receptor is assumed to be exposed to COPC in surface and subsurface soils during excavation activity. Based on this exposure scenario, the "farmer" receptor provided in the EFH is considered to provide an upper-bound estimate of soil adherence. A soil ingestion rate can be calculated by substituting the soil adherence value for the receptor for the estimated value derived by Hawley (1985), as follows:

$$\frac{480\ mg/day}{3.5\ mg/cm^2} = \frac{ingestion\ rate\ (mg/day)}{soil\ adherence\ (mg/cm^2)}$$

The soil adherence value for the "farmer" is 0.47 mg/cm^2. The calculated soil ingestion value is 64 mg/day; therefore, a soil ingestion rate of 64 mg/day is used for the MLE construction worker receptor in this risk evaluation.

Additional support for this value comes from a new paper by Kissel and coworkers (Kissel et al., 1998) that presents the results of a study of the transfer of soil from hand to mouth by intentional licking. Soil was loaded onto the skin by pressing the hand onto soil, and the amount transferred to the mouth was measured. The thumb sucking, finger mouthing, and palm licking activities resulted in geometric mean soil mass transfers of 7.4 to 16 mg per event. The author concludes that "transfer of 10 mg or more of soil from a hand to the oral cavity in one event is possible, but requires moderate soil loading and more than incidental hand-to-mouth contact." However, "the fraction of soil transferred from hand to mouth that is subsequently swallowed is unknown but may be less than 100 percent." In addition, "the adult volunteers in this study reported that the presence of roughly 10 mg of soil in the mouth is readily detected (and unpleasant). Repeated unintentional ingestion of that mass of soil by adults therefore seems unlikely. In light of this observation, the 480 mg per day estimate [of Hawley, 1985] would require hundreds or perhaps thousands of hand-to-mouth contacts that resulted in soil transfer per day."

The 64 mg/day soil ingestion rate for the industrial and construction worker receptors recommended here is supported by this study, as 5 hand to mouth events during the course of a workday is more reasonable to assume than 48 or more.

For the RME scenario, a soil ingestion rate of 100 mg/day is assumed for the construction worker. This is the adult soil ingestion rate provided by USEPA (1991).

5.4.2 Frequency of Exposure to COPC in Soil

A meteorological factor is generally used to account for the fraction of the year during which exposure to constituents in soils may occur (Sheehan et al., 1991; USEPA, 1989a). It is reasonable to assume that direct contact with soil or intrusive activities will not occur for residential receptors during inclement weather, i.e., when it is raining or snowing, when the ground is wet or frozen, or when snow or ice (32 degrees F) are covering the ground. Thus the frequency of contact with potentially impacted soil is adjusted for these site-specific meteorological conditions (USEPA, 1989a).

There are only a few metrics that can be used to describe the fraction of the year when meteorological conditions are likely to limit exposure. These include temperature and the amount of precipitation per day and per year, which includes rain, snow and ice. While measures are collected hourly, the National Weather Service reports the number of days when precipitation is greater than 0.01 inches (one one-hundredth), greater than 0.1 inches (one tenth), and greater than 1 inch in their annual summary data. The number of days with precipitation greater than 0.1 inches is selected as the best representation of when exposure is likely to be limited by snow, rain, or ice. The National Oceanographic and Atmospheric Administration (NOAA) provides daily temperature data. It is assumed that exposure to soils is limited by temperatures less than 32 degrees F. Therefore, limiting the assumption of exposure to soils to those days with less than 0.1 inch of precipitation and temperatures above 32 degrees F is reasonable.

Based on ten years of meteorological data (1986-1995) provided by NOAA (1996), a meteorological factor is derived for use in the exposure equations. On the average, 66 days/year in this area receive 0.1 or greater inches of precipitation, and there are typically 27 days/year with a mean temperature of 32 degrees F or below. Accounting for days when both events occur (assumed to be 10% of the rain days or 6 days/year), the number of inclement days, 87, can be calculated (27 + 66 – 6 = 87). It is assumed that these days are evenly spaced throughout the course of the year. The meteorological factor is then calculated (87/365 = 24%). Thus it is assumed that exposure to soils will not occur for the "receptor" 24% of the assumed days of exposure (exposure frequency) due to weather restrictions.

The choice of a precipitation target of 0.1 inches is in keeping with guidance provided in the Compilation of Air Pollution Emission Factors, which assumes that soil suspension will not occur on days with more than 0.01 inches of precipitation (USEPA, 1995b). It is probable, however, that this metric both over- and under-estimates the potential exposure in some conditions. For, example, it is possible that some exposure to soils may occur on days when it rains just over 0.1 inches in the early morning and then the ground dries during the course of the day. Alternatively, significant rainfall, such as greater than 1 inch, is likely to saturate the soil for consecutive days, and several inches of snow (which may fall all on one day with one storm) may cover the ground and inhibit direct contact for several days. With both of these considerations in mind, it is likely that a meteorological factor based on inclement days defined as precipitation greater than 0.1 inches and average temperatures less than 32 degrees F is reasonable.

5.5 Quantification of Potential Exposures

To estimate the potential risk to human health that may be posed by the presence of COPC at the site, it is first necessary to estimate the potential exposure dose of each COPC. The exposure dose is estimated for each constituent via each exposure pathway by which the receptor is assumed to be exposed. Exposure dose equations combine the estimates of constituent concentration in the environmental medium of interest with assumptions regarding the type and magnitude of each receptor's potential exposure to provide a numerical estimate of the exposure dose. The exposure dose is defined as the amount of COPC taken into the receptor and is expressed in units of milligrams of COPC per kilogram of body weight per day (mg/kg-day).

Exposure doses are defined differently for potential carcinogenic and noncarcinogenic effects. The Chronic Average Daily Dose (CADD) is used to estimate a receptor's potential intake from exposure to a COPC with noncarcinogenic effects. According to USEPA (1989a), the CADD should be calculated by averaging the dose over the period of time for which the receptor is assumed to be exposed. Therefore, the averaging period is the same as the exposure duration. For COPC with potential carcinogenic effects, however, the Lifetime Average Daily Dose (LADD) is employed to estimate potential exposures. In accordance with USEPA (1989a) guidance, the LADD is calculated by averaging exposure over the receptor's assumed lifetime (70 years). Therefore, the averaging period is the same as the receptor's assumed lifetime. The standardized equations for estimating a receptor's average daily dose (both lifetime and chronic) are presented below, followed by descriptions of receptor-specific exposure parameters and constituent-specific parameters.

5.5.1 Estimating Potential Exposure from Ingestion of and Dermal Contact with Soil or Sediment

Both incidental ingestion of, and dermal contact with, soil and/or sediment are assumed to occur for many of the receptors. The following equations are used to calculate the estimated exposure.

Average Daily Dose (Lifetime and Chronic) Following Incidental Ingestion of Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \times IR \times EF \times ED \times AAF_o \times CF}{BW \times AT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CS	=	Soil concentration (mg/kg soil)
IR	=	Ingestion rate (mg soil/day)
EF	=	Exposure frequency (days)
ED	=	Exposure duration (year)
AAF_o	=	Oral-Soil Absorption Adjustment Factor (AAF) (unitless)
CF	=	Unit conversion factor (kg soil/10^6 mg soil)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Soil or Sediment (mg/kg-day):

$$ADD = \frac{CS \, x \, SA \, x \, AF \, x \, EF \, x \, ED \, x \, AAF_d \, x \, CF}{BW x AT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CS	=	Soil concentration (mg/kg soil)
SA	=	Exposed skin surface area (cm^2/day)
AF	=	Soil to skin adherence factor (mg soil/cm^2)
EF	=	Exposure frequency (days)
ED	=	Exposure duration (year)
AAF_d	=	Dermal-Soil AAF (unitless)
CF	=	Unit conversion factor (kg soil/10^6 mg soil)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

5.5.2 Estimating Potential Exposure via Inhalation

Exposure to COPC migrating from soil to air is assumed to occur for many of the potential receptors. The equation used to estimate exposure to COPC via inhalation is as follows:

Average Daily Dose (Lifetime and Chronic) Following Inhalation of COPC (mg/kg-day):

$$ADD = \frac{CA \, x \, IR \, x \, AAF_i \, x \, ET \, x \, EF \, x \, ED}{BW x AT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CA	=	Air concentration (mg/m^3)
IR	=	Inhalation rate (m^3 /hr)
AAF_i	=	Inhalation AAF (unitless)
ET	=	Exposure time (hours/day)
EF	=	Exposure frequency (days)
ED	=	Exposure duration (year)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

5.5.3 Estimating Potential Exposure from Groundwater/Surface Water

A potential construction worker may contact COPC in groundwater during soil excavation. The risk assessment assumes that the recreational teenager will come in contact with surface waters of Dead Creek and Borrow Pit Lake. In addition, residents could contact groundwater via outdoor use of private well water. The equation used to estimate a receptor's potential exposure via incidental ingestion of groundwater/surface water is:

Average Daily Dose (Lifetime and Chronic) Following Ingestion of Water (mg/kg-day):

$$ADD = \frac{CW \times IR \times EF \times ED \times AAF_o \times CF}{BWxAT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CW	=	Water concentration (mg/L)
IR	=	Water ingestion rate (L/day)
EF	=	Exposure frequency (days)
ED	=	Exposure duration (year)
AAF_o	=	Oral-water AAF (unitless)
BW	=	Body weight (kg)
AT	=	Averaging time (days)

The equation used to estimate a receptor's potential exposure via dermal contact with groundwater/surface water is as follows:

Average Daily Dose (Lifetime and Chronic) Following Dermal Contact with Water (mg/kg-day):

$$ADD = \frac{CW \times SA \times PC \times ET \times EF \times ED \times AAF_d \times CF}{BWxAT}$$

where:

ADD	=	Average Daily Dose (mg/kg-day)
CW	=	Water concentration (mg/L)
SA	=	Exposed skin surface area (cm^2/day)
PC	=	Dermal permeability constant (cm/hr)
ET	=	Exposure time (hours/day)
EF	=	Days exposed per year (day/365 day)
ED	=	Years exposed (year)

indoor air, and generation of fugitive dust and volatiles from undisturbed soils as well as during construction activities.

The model to be used to predict indoor air concentrations of VOCs will be the model of Johnson and Ettinger recommended by the USEPA (1996a and 1997c) to predict concentrations of COPC migrating from groundwater or soil to indoor air of an overlying building. Concentrations of volatile COPC in outdoor air due to migration from subsurface soil and/or groundwater will be estimated using the methodology recommended by the American Society for Testing and Materials (ASTM, 1995).

The calculation of concentrations of inorganic and semivolatile organic COPC bound to soil in fugitive dust involves multiplying the soil exposure point concentrations by the concentration of dust in air as follows:

1) Ambient Air:

   COPC concentration in ambient air (mg/m^3) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (kg soil/m^3)

   The dust concentration in air to be used in the evaluation of ambient outdoor air pathways in this risk evaluation is the inverse of the particulate emission factor derived in accordance with USEPA guidance (USEPA, 1996a).

2) Excavation Air (i.e., during construction activities):

   COPC concentration in excavation air (mg/m^3) = Exposure point concentration in soil (mg/kg soil) x Dust concentration (mg soil/m^3) x Unit correction factor (1 kg/10^6 mg)

   The dust concentration in air to be used in the evaluation of excavation air pathways in this risk evaluation is 60 mg/m^3. This value is the recommended concentration of respirable particulate with a mean diameter of 10 microns or less (PM10) for excavation activities (MADEP, 1995).

COPC concentrations in homegrown produce are dependent upon the potential for direct uptake of COPC from soil through plant roots and will be estimated via the following equation:

   COPC Concentration in Produce (mg COPC/kg plant tissue) = Concentration of COPC in soil (mg COPC/kg Soil) x Root Uptake Factor (unitless)

The root uptake factor accounts for uptake from soil to the homegrown produce. As appropriate, chemical-specific root uptake factors will be identified from sources such as Baes et al. (1984) for use in the risk assessment.

TABLE 5-1
RECEPTOR-AREA MATRIX
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Receptor	Exposure Areas																			
Medium	Fill Area/Sites						Creek Segments						Residential/Commercial/Undeveloped Transects							Total
Secondary Medium (Pathways)	G	H	I	L	M (lagoon)	N	Ref. Area	CS-B	CS-C	CS-D	CS-E	CS-F	1	2	3	4	5	6	7	Receptors
Indoor Industrial Worker (IW)																				
Fill Area: Subsurface Waste	IW-RME-G	IW-RME-H	IW-RME-I	IW-RME-L		IW-RME-N							IW-RME-C/R-1	IW-RME-C/R-2	IW-RME-C/R-3	IW-RME-C/R-4	IW-RME-C/R-5	IW-RME-C/R-6	IW-RME-C/R-7	12
Indoor Air (inh)	IW-MLE-G	IW-MLE-H	IW-MLE-I	IW-MLE-L		IW-MLE-N							IW-MLE-C/R-1	IW-MLE-C/R-2	IW-MLE-C/R-3	IW-MLE-C/R-4	IW-MLE-C/R-5	IW-MLE-C/R-6	IW-MLE-C/R-7	12
Transects: Subsurface Soil																				
Indoor Air (inh)																				
Groundwater																				
Indoor Air (inh)																				
Outdoor Industrial Worker (OW)																				
Surface Soil (ing/derm)																				
Outdoor Air (inh)																				
Fill Area: Subsurface Waste	OW-RME-G	OW-RME-H	OW-RME-I	OW-RME-L		OW-RME-N							OW-RME-C/R-1	OW-RME-C/R-2	OW-RME-C/R-3	OW-RME C/R-4	OW-RME-C/R-5	OW-RME-C/R-6	OW-RME-C/R-7	12
Outdoor Air (inh)	OW-MLE-G	OW-MLE-H	OW-MLE-I	OW-MLE-L		OW-MLE-N							OW-MLE-C/R-1	OW-MLE-C/R-2	OW-MLE-C/R-3	OW-MLE-C/R-4	OW-MLE-C/R-5	OW-MLE-C/R-6	OW-MLE-C/R-7	12
Transects: Subsurface Soil																				
Outdoor Air (inh)																				
Groundwater																				
Outdoor Air (inh)																				
Construction Worker (CW)																				
Surface Soil (ing/derm)																				
Outdoor Air (inh)																				
Fill Area: Subsurface																				
Waste (ing/derm)	CW-RME-G	CW-RME-H	CW-RME-I	CW-RME-L		CW-RME-N							CW-RME-C/R-1	CW-RME-C/R-2	CW-RME-C/R-3	CW-RME-C/R-4	CW-RME-C/R-5	CW-RME-C/R-6	CW-RME-C/R-7	12
Outdoor Air (inh)	CW-MLE-G	CW-MLE-H	CW-MLE-I	CW-MLE-L		CW-MLE-N							CW-MLE-C/R-1	CW-MLE-C/R-2	CW-MLE-C/R-3	CW-MLE-C/R-4	CW-MLE-C/R-5	CW-MLE-C/R-6	CW-MLE-C/R-7	12
Transects: Subsurface Soil (ing/derm)																				
Outdoor Air (inh)																				
Groundwater (ing/derm)																				
Outdoor Air (inh)																				
Trespassing Teenager (TT)																				
Surface Soil (ing/derm)																				
Outdoor Air (inh)																				
Subsurface Waste	TT-RME-G	TT-RME-H	TT-RME-I	TT-RME-L		TT-RME-N														5
Outdoor Air (inh)	TT-MLE-G	TT-MLE-H	TT-MLE-I	TT-MLE-L		TT-MLE-N														5
Groundwater																				
Outdoor Air (inh)																				
Recreational Teen (RT)																				
Sediment (ing/derm)					*			*	**	**	***									
					RT-RME-M		RT-RME-REF	RT-RME-CS-B	RT-RME-CS-C	RT-RME-CS-D	RT-RME-CS-E	RT-RME-CS-F								7
Surface Water (ing/derm)					RT-MLE-M		RT-MLE-REF	RT-MLE-CS-B	RT-MLE-CS-C	RT-MLE-CS-D	RT-MLE-CS-E	RT-MLE-CS-F								7
Recreational Fisher (RF)																				
Sediment (ing/derm)																				
Surface Water (ing/derm)							RF-RME-REF					RF-RME-F								2
							RF-MLE-REF					RF-MLE-F								2
Fish Tissue (ing)																				
Resident (RES)																				
Surface Soil (ing/derm)																				
Outdoor Air (inh)																				
Subsurface Soil (or Waste in Site N)																				
Indoor/Outdoor Air (inh)													*	*	**	**	**	***	***	
Groundwater (ing/derm)					RES-RME-M	RES-RME-N							RES-RME-C/R-1	RES-RME-C/R-2	RES-RME-C/R-3	RES-RME-C/R-4	RES-RME-C/R-5	RES-RME-C/R-6	RES-RME-C/R-7	9
Indoor/Outdoor Air (inh)					RES-MLE-M (a)	RES-MLE-N							RES-MLE-C/R-1	RES-MLE-C/R-2	RES-MLE-C/R-3	RES-MLE-C/R-4	RES-MLE-C/R-5	RES-MLE-C/R-6	RES-MLE-C/R-7	9
Produce (ing)																				****
Total Receptors	8	8	8	8	4	10	4	2	2	2	2	4	4	4	4	4	4	4	4	**118**

Notes:

RME - Reasonable Maximum Exposure
MLE - Most Likely Exposure
ing - ingestion
derm - dermal contact
inh - inhalation

* *In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 1 and 2 will be added to risks for the recreational teen in CS-B and site M.*
** In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 3,4 and 5 will be added to risks for the recreational teen in CS-C and CS-D.
*** In addition to separate risk calculations, due to proximity, risks for residential receptors for transects 6 and 7 will be added to risks for the recreational teen in CS-E.
****There are 116 receptors - each is evaluated for several exposure pathways.
(a) - The residential scenario for area M will consider inhalation of sediment derived dust by nearby residential receptors (i.e., transects 1 and 2) should the lagoon be drained and dried in the future.

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Receptor / Exposure Route	Environmental Medium	Sampling Strategy	Number of Samples
Indoor Industrial Worker Inhalation of Indoor Air	Fill Area Waste	At Sites G,H,I,L and N: Collect 1 sample from each of 4 borings at each site.	20 samples
Outdoor Industrial Worker Inhalation of Outdoor Air			
Teenage Trespasser Inhalation of Outdoor Air			
Construction/Utility Worker • Incidental Ingestion of and Dermal Contact with Waste • Inhalation of Particulates and Volatiles			
Outdoor Industrial Worker • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles	Fill Area Surface Soil (0-0.5 ft bgs)	At Sites G,H,I,L and N: Collect 1 sample from each of 4 borings at each site.	20 samples
Teenage Trespasser • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles			
Construction/Utility Worker • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles			

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Receptor / Exposure Route	Environmental Medium	Sampling Strategy	Number of Samples
Indoor Industrial Worker Inhalation of Indoor Air	Fill Area Groundwater	Indoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs.	• Fill Area shallow groundwater - 19 samples from 19 wells.
Outdoor Industrial Worker Inhalation of Outdoor Air		Outdoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs.	• Downgradient shallow alluvial aquifer
Construction/Utility Worker Inhalation of Outdoor Air			
Recreational Teenager Inhalation of Outdoor Air			
Construction/Utility Worker Incidental Ingestion of and Dermal Contact with Groundwater		Sample Shallow groundwater. Excavation is generally not expected to exceed 15 ft bgs; however, most shallow samples from each well will be used.	1) Sites G,H, and L: 3-6 samples from 3 locations. 2) Site I: 3-6 samples from 3 locations. 3) Areas southwest of sites G,H, and L: 3-6 samples from 3 wells.
Indoor Industrial Worker Inhalation of Indoor Air	Residential Area Groundwater	Indoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs.	Developed and Undeveloped Areas in Dead Creek Floodplain closest to source areas:
Resident Inhalation of Indoor Air			
Outdoor Industrial Worker Inhalation of Outdoor Air		Outdoor air concentrations of VOCs will be modeled based on shallow groundwater concentrations of VOCs.	
Construction/Utility Worker Inhalation of Outdoor Air			
Resident Inhalation of Outdoor Air			
Construction/Utility Worker Incidental Ingestion of and Dermal Contact with Groundwater		Sample Shallow groundwater. Excavation is generally not expected to exceed 15 ft bgs; however, most shallow samples from each well will be used.	6 samples from 2 wells at water table (Walnut St. and Judith Ln.)
Resident Incidental Ingestion of and Dermal Contact with Groundwater		Sample groundwater in the developed and undeveloped areas of the Dead Creek Floodplain.	4 samples from yet to be identified private wells in the Walnut St. and Judith Ln. area.

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Receptor / Exposure Route	Environmental Medium	Sampling Strategy	Number of Samples
Construction/Utility Worker • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles	Residential Area Surface Soils (0-0.5 ft bgs)	Seven transects in undeveloped areas sampled at 200 ft. intervals. Three residences along each of Transects 1-6, and two residences along Transect 7.	45 samples 20 samples
Outdoor Industrial Worker • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles			
Resident • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles in Outdoor Air			
Resident • Produce Ingestion		Produce constituent concentrations will be modeled based on surface soil data collected along undeveloped area transects and at residences.	
Construction/Utility Worker • Incidental Ingestion of and Dermal Contact with Soil • Inhalation of Particulates and Volatiles	Residential Area Subsurface Soils (0.5- 6 ft bgs)	Seven transects in undeveloped areas sampled at 200 ft. intervals. Three residences along each of Transects 1-6, and two residences along Transect 7.	45 samples 20 samples
Outdoor Industrial Worker • Inhalation of Volatiles			
Resident • Inhalation of Volatiles			
Indoor Industrial Worker • Inhalation of Volatiles			

TABLE 5-2
SAMPLING IN SUPPORT OF THE HUMAN HEALTH RISK ASSESSMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Receptor / Exposure Route	Environmental Medium	Sampling Strategy	Number of Samples
Recreational Teenager Incidental Ingestion of and Dermal Contact with Sediment while Wading	Dead Creek Sediment *	Sample undeveloped areas of Dead Creek (CS-B and CS-F) at 200 ft. intervals for industry-specific constituents.	50 samples
		Sample developed areas of Dead Creek (CS-C,D and E) at 150 ft. intervals for industry-specific constituents.	47 samples
		Sample entire length of Dead Creek at 1000 ft. intervals for full suite of analytes.	20 samples
	Site M sediment	Sample Site M sediments.	4 samples
Recreational Teenager Incidental Ingestion of and Dermal Contact with Sediment while Swimming Recreational Fisher Incidental Ingestion of and Dermal Contact with Sediment while Wading	Borrow Pit Lake Sediment North of Dead Creek Discharge *	Sample Borrow Pit Lake at 400 ft. intervals for industry-specific constituents.	8 samples
Recreational Teenager Incidental Ingestion of and Dermal Contact with Surface Water while Wading	Dead Creek Surface Water	Sample Dead Creek Surface Water at approximately 1000 ft. intervals for full suite of analytes.	18 samples
Recreational Teenager Incidental Ingestion of and Dermal Contact with Surface Water while Swimming Recreational Fisher Incidental Ingestion of and Dermal Contact with Surface Water while Wading	Borrow Pit Lake Surface Water North of Dead Creek Discharge	Sample Borrow Pit Lake Surface Water at approximately 1000 ft. intervals for site-specific constituents.	2 samples
Recreational Fisher Fish Ingestion	Various Fish in Borrow Pit Lake	9 predator fish, 9 bottom feeding fish and 9 forage fish whole fish samples will be collected. Compositing will be conducted as necessary to achieve appropriate sample size. Data from game fish will be used in the HHRA.	27 samples

Notes:
bgs - below ground surface.
ft - feet.
* In addition, sediment sampling conducted in support of the ecological risk assessment will be used in the human heath risk assessment.

TABLE 5-3
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - INDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME On-Site Indoor Worker		MLE On-Site Indoor Worker	
Parameters Used in the Indoor Air Pathway				
Exposure Time (hr/day)	8	(a)	8	(a)
Exposure Frequency (days/year)	250	(b)	250	(b)
Exposure Duration (yr)	25	(b)	7	(c)
Inhalation Rate (m^3/hour)	1.6	(d)	1.0	(e)
Body Weight (kg)	70	(b)	70	(b)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.

6/22/99

TABLE 5-4
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Future Outdoor Industrial Worker		MLE Future Outdoor Industrial Worker	
Parameters Used in the Outdoor Air Pathway				
Exposure Time (hr/day)	8	(a)	8	(a)
Exposure Frequency (days/year)	190	(i)	190	(i)
Exposure Duration (yr)	25	(b)	7	(c)
Inhalation Rate (m^3/hour)	1.6	(d)	1	(e)
Body Weight (kg)	70	(b)	70	(b)
Parameters Used in the Surface Soil Pathway				
Exposure Frequency (days/year)	190	(i)	190	(i)
Exposure Duration (yr)	25	(b)	7	(c)
Soil Ingestion Rate (mg/day)	50	(f)	30	(j)
Skin Contacting Medium (cm^2)	3339	(g)	3339	(g)
Soil on Skin (mg/cm^2)	0.02	(h)	0.02	(h)
Body Weight (kg)	70	(b)	70	(b)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended value for occupational tenure listed in Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for moderate activity.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate for light activity.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(h) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-10 for calculation.
(i) - Exposure frequency of 250 days (USEPA, 1991a) adjusted for percentage of days with inclement weather (24%). [250-(250*0.24) = 190]; see text.
(j) - Calabrese, E.J., et. al. 1990. Preliminary adult soil ingestion estimates; results of a pilot study. Regul. Toxicol. Pharmacol. 12L88-95. As cited in USEPA, 1997a. Exposure Factors Handbook. Low end of range.

6/22/99

TABLE 5-5
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - TRESPASSING TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Trespassing Teenager (7 to 18 yrs)		MLE Trespassing Teenager (7 to 18 yrs)	
Parameters Used in the Surface Soil Pathway				
Exposure Frequency (days/year)	26	(a)	13	(b)
Exposure Duration (yr)	11	(c)	11	(c)
Soil Ingestion Rate (mg/day)	100	(d)	50	(e)
Skin Contacting Medium (cm^2)	3677	(f)	3677	(f)
Soil on Skin (mg/cm^2)	0.02	(g)	0.02	(g)
Body Weight (kg)	47	(h)	47	(h)
Parameters Used in the Outdoor Air Pathway				
Exposure Time (hr/day)	2	(i)	2	(i)
Exposure Frequency (days/year)	26	(a)	13	(b)
Exposure Duration (yr)	11	(c)	11	(c)
Inhalation Rate (m^3/hour)	1.2	(j)	1	(k)
Body Weight (kg)	47	(h)	47	(h)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Trespassing teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991a. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of hands, forearms and lower legs of males and females aged 7 to 18.
(g) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-14 for calculation.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7 to 18.
(i) - The trespassing teen is assumed to stay in the fill area for two hours.
(j) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for moderate activity (children) listed in Table 5-23.
(k) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates is the value for light activity (children) listed in Table 5-23.

6/22/99

TABLE 5-6
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Future Construction/Utility Worker		MLE Future Construction/Utility Worker	
Parameters Used in the Surface Soil and Subsurface Soil Inhalation Pathway				
Exposure Time (hr/day)	8	(a)	8	(a)
Exposure Frequency (days/year)	40	(b)	20	(c)
Exposure Duration (yr)	1	(d)	1	(d)
Inhalation Rate (m^3/hour)	2.5	(e)	1.5	(f)
Body Weight (kg)	70	(g)	70	(g)
Parameters Used in the Surface and Subsurface Soil Pathway				
Exposure Frequency (days/year)	40	(b)	20	(c)
Exposure Duration (yr)	1	(d)	1	(d)
Soil Ingestion Rate (mg/day)	100	(g)	64	(h)
Skin Contacting Medium (cm^2)	3339	(i)	3339	(i)
Soil on Skin (mg/cm^2)	0.19	(j)	0.19	(j)
Body Weight (kg)	70	(g)	70	(g)
Parameters Used in the Groundwater Pathway				
Exposure Time (hr/event)	1	(k)	1	(k)
Exposure Frequency (days/year)	10	(k)	5	(k)
Exposure Duration (yr)	1	(d)	1	(d)
Water Ingestion Rate (l/event)	0.005	(l)	0.005	(l)
Skin Contacting Medium (cm^2)	3339	(i)	3339	(i)
Body Weight (kg)	70	(g)	70	(g)
Parameters Used in the Groundwater Inhalation Pathway				
Exposure Time (hr/day)	8	(a)	8	(a)
Exposure Frequency (days/year)	40	(b)	20	(c)
Exposure Duration (yr)	1	(d)	1	(d)
Inhalation Rate (m^3/hour)	2.5	(e)	1.5	(f)
Body Weight (kg)	70	(g)	70	(g)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. 50th percentile time spent at work, males and females, all ages. Table 15-68.
(b) - Exposure frequency is equivalent to 5 days per week for 2 months.
(c) - Exposure frequency is equivalent to five days per week for one month.
(d) - Construction activities are assumed to occur over a 1 year period.
(e) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for heavy activity for an outdoor worker listed in Table 5-23.
(f) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rate is the value for moderate activity for an outdoor worker listed in Table 5-23.
(g) - USEPA, 1991a. Standard Default Exposure Factors.
(h) - ENSR-derived value; described briefly in the text.
(i) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, forearms, and face.
(j) - USEPA, 1997a. Exposure Factors Handbook. See Table 5-11 for calculation.
(k) - Assumed that contact with water occurs only for a fraction of the total exposure duration and time.
(l) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

6/22/99

TABLE 5-7
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RESIDENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Resident				MLE Resident			
	Adult		Child (0 to 6 yrs)		Adult		Child (0 to 6 yrs)	
Parameters Used in the Outdoor Air Inhalation Pathway								
Exposure Time (hr/day)	2	(a)	6	(a)	2	(a)	6	(a)
Exposure Frequency (days/year)	266	(c)	266	(c)	178	(e)	178	(e)
Exposure Duration (yr)	24	(b)	6	(b)	7	(f)	2	(f)
Inhalation Rate (m^3/hour)	1.6	(g)	1.2	(g)	0.55	(h)	0.32	(i)
Body Weight (kg)	70	(b)	15	(b)	70	(b)	15	(b)
Parameters Used in the Surface Soil Pathway								
Exposure Frequency (days/year)	266	(c)	266	(c)	178	(e)	178	(e)
Exposure Duration (yr)	24	(b)	6	(b)	7	(f)	2	(f)
Soil Ingestion Rate (mg/day)	100	(b)	200	(b)	50	(j)	100	(j)
Skin Contacting Medium (cm^2)	5729	(k)	2058	(k)	5729	(k)	2058	(k)
Soil on Skin (mg/cm^2)	0.12	(l)	0.06	(l)	0.12	(l)	0.06	(l)
Body Weight (kg)	70	(b)	15	(b)	70	(b)	15	(b)
Parameters Used in the Homegrown Produce Pathway								
Exposure Frequency (days/year)	365	(p)	365	(p)	365	(p)	365	(p)
Exposure Duration (yr)	24	(b)	6	(b)	7	(f)	2	(f)
Produce Ingestion Rate (g/day)	525	(m)	113	(m)	147	(n)	31.5	(n)
Body Weight (kg)	70	(b)	15	(b)	70	(b)	15	(b)
Parameters Used in the Indoor Air Inhalation Pathway								
Exposure Time (hr/day)	16.4	(o)	18	(o)	16.4	(o)	18	(o)
Exposure Frequency (days/year)	266	(c)	266	(c)	178	(e)	178	(e)
Exposure Duration (yr)	24	(b)	6	(b)	7	(f)	2	(f)
Inhalation Rate (m^3/hour)	1.6	(g)	1.2	(g)	0.55	(h)	0.32	(i)
Body Weight (kg)	70	(b)	15	(b)	70	(b)	15	(b)
Parameters Used in the Groundwater Pathway								
Exposure Time (hr/event)	1	(r)	1	(r)	1	(r)	1	(r)
Exposure Frequency (days/year)	26	(s)	26	(s)	13	(t)	13	(t)
Exposure Duration (yr)	24	(b)	6	(b)	7	(f)	2	(f)
Water Ingestion Rate (l/event)	0.005	(q)	0.005	(q)	0.001	(u)	0.001	(u)
Skin Contacting Medium (cm^2)	5729	(k)	2058	(k)	5729	(k)	2058	(k)
Body Weight (kg)	70	(b)	15	(b)	70	(b)	15	(b)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent outdoors listed in Table 1-2 (average of weekends /weekdays for children).
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - Exposure frequency of 350 days (USEPA, 1991a) adjusted for percentage of days with inclement weather (24%), [350-(350*0.24) = 266]; See text.
(d) - USEPA, 1993b. Central tendency residential exposure frequency = 234 days.
(e) - Exposure frequency of 234 days (USEPA, 1993b) adjusted for percentage of days with inclement weather (24%), [234 - (234*0.24) = 178]; See text.
(f) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household, Table 1-2. (9 years total, assuming 7 years as an adult and 2 as a child - assumes that the 2 years as a child can occur anywhere between the ages of 0 to 6. Therefore, exposure factors for a 0 to 6 year old child are employed).
(g) - USEPA, 1997a. Exposure Factors Handbook. Inhalation rates are the values for moderate activity listed in Table 5-23.
(h) - USEPA, 1997a. Exposure Factors Handbook. Average daily inhalation rate for men and women, Table 5-23.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average of recommended inhalation rates for children age 0-6 years, Table 5-23.
(j) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(k) - USEPA, 1997a. Exposure Factors Handbook. Represents average 50th percentile surface area for males and females of hands, forearms, lower legs, and feet.
(l) - USEPA, 1997a. Exposure Factors Handbook. See Tables 5-12 and 5-13 for calculation.
(m) - USEPA, 1997a. Exposure Factors Handbook. Based on recommended 95th percentile homegrown vegetable intake of 7.5 g/kg body weight-day, Table 1-2.
(n) - USEPA, 1997a. Exposure Factors Handbook. Based on average homegrown vegetable intake of 2.1 g/kg body weight-day, Table 1-2.
(o) - USEPA, 1997a. Exposure Factors Handbook. Values for time spent indoors listed in Table 1-2 (average of weekends /weekdays for children; assumes that adult spends time away from the household).
(p) - Produce ingestion rate is based on 365 days per year.
(q) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(r) - The adult and child are assumed to be in contact with groundwater outdoors for one hour per event.
(s) - Two days per week for three months.
(t) - One day per week for three months.
(u) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fiftieth of that assumed to occur during a swimming event.

TABLE 5-8
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL TEENAGER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Recreational Teenager (7 to 18 yrs)		MLE Recreational Teenager (7 to 18 yrs)	
Parameters Used in the Dead Creek Sediment Pathway - Wading				
Exposure Frequency (days/year)	26	(a)	13	(b)
Exposure Duration (yr)	11	(c)	11	(c)
Soil Ingestion Rate (mg/day)	100	(d)	50	(e)
Skin Contacting Medium (cm^2)	2029	(f)	2029	(f)
Sediment on Skin (mg/cm^2)	1	(g)	1	(g)
Body Weight (kg)	47	(h)	47	(h)
Parameters Used in the Dead Creek Surface Water Pathway - Wading				
Exposure Frequency (days/year)	26	(a)	13	(b)
Exposure Duration (yr)	11	(c)	11	(c)
Surface Water Ingestion Rate (l/event)	0.01	(i)	0.005	(j)
Skin Contacting Medium (cm^2)	2029	(f)	2029	(f)
Body Weight (kg)	47	(h)	47	(h)
Paramaters Used in the Borrow Pit Lake Sediment Pathway - Swimming				
Exposure Frequency (days/year)	12	(k)	6	(l)
Exposure Duration (yr)	11	(c)	11	(c)
Soil Ingestion Rate (mg/day)	100	(d)	50	(e)
Skin Contacting Medium (cm^2)	2029	(f)	2029	(f)
Sediment on Skin (mg/cm^2)	1	(g)	1	(g)
Body Weight (kg)	47	(h)	47	(h)
Parameters Used in the Borrow Pit Lake Surface Water Pathway - Swimming				
Exposure Frequency (days/year)	12	(k)	6	(l)
Exposure Duration (yr)	11	(c)	11	(c)
Surface Water Ingestion Rate (l/event)	0.05	(m)	0.01	(i)
Skin Contacting Medium (cm^2)	13533	(n)	13533	(n)
Body Weight (kg)	47	(h)	47	(h)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - 1 day per week for 26 weeks (6 months) of the year.
(b) - 1 day per 2 weeks for 26 weeks (6 months) of the year.
(c) - Recreational teenager is assumed to range in age from 7 to 18. Therefore, total exposure duration is 11 years.
(d) - USEPA, 1991a. Standard Default Exposure Factors.
(e) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rate for an adult listed in Table 1-2.
(f) - USEPA, 1997a. Exposure Factors Handbook. Average surface are of feet and 1/4 the legs of males and females aged 7-18.
(g) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(h) - USEPA, 1997a. Exposure Factors Handbook. Body weight is the average of males and females aged 7-18.
(i) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(j) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.
(k) - Two events per month for the 6 warmest months of the year.
(l) - One events per month for the 6 warmest months of the year.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value for a swimming event.
(n) - Value represents average total body surface area of males and females aged 7 to 18. Assumed 100% of skin surface exposed while swimming.

6/22/99

TABLE 5-9
SUMMARY OF POTENTIAL EXPOSURE ASSUMPTIONS - RECREATIONAL FISHER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Parameter	RME Adult Recreational Fisher		MLE Adult Recreational Fisher	
Parameters Used in the Fish Ingestion Pathway				
Exposure Frequency (days/year)	365	(a)	365	(a)
Exposure Duration (yr)	30	(b)	9	(c)
Fish Ingestion Rate (g/day)	8	(d)	1	(e)
Body Weight (kg)	70	(b)	70	(b)
Parameters Used in the Surface Water Pathway - Wading				
Exposure Frequency (days/year)	22	(k)	3	(l)
Exposure Duration (yr)	30	(b)	9	(c)
Surface Water Ingestion Rate (l/event)	0.01	(f)	0.005	(m)
Skin Contacting Medium (cm^2)	4500	(g)	4500	(g)
Body Weight (kg)	70	(b)	70	(b)
Paramaters Used in the Sediment Pathway - Wading				
Exposure Frequency (days/year)	22	(k)	3	(l)
Exposure Duration (yr)	30	(b)	9	(c)
Sediment Ingestion Rate (mg/day)	100	(h)	50	(i)
Skin Contacting Medium (cm^2)	4500	(g)	4500	(g)
Sediment on Skin (mg/cm^2)	1	(j)	1	(j)
Body Weight (kg)	70	(b)	70	(b)

Notes:
MLE - Most Likely Exposure.
RME - Reasonable Maximum Exposure.
(a) - Fish ingestion rates are based on 365 days per year.
(b) - USEPA, 1991a. Standard Default Exposure Factors.
(c) - USEPA, 1997a. Exposure Factors Handbook. Recommended average for time residing in a household. Table 1-2.
(d) - USEPA, 1997a. Exposure Factors Handbook. 8 g/day is equivalent to approximately 22 fish meals of 129 g per year.
(e) - 1 g/day is equivalent to approximately three 129 g fish meals per year (equivalent to one fish meal per month in the three summer months).
(f) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-fifth of that assumed to occur during a swimming event.
(g) - USEPA, 1997a. Exposure Factors Handbook. Represents 50th percentile values for males and females based on hands, lower legs, and feet.
(h) - USEPA, 1991a. Standard Default Exposure Factors.
(i) - USEPA, 1997a. Exposure Factors Handbook. Average soil ingestion rates listed in Table 1-2.
(j) - USEPA, 1992b. Dermal Exposure Assessment: Principles and Applications.
(k) - One day per month for 5 months.
(l) - One day per month during the three summer months.
(m) - USEPA, 1989a. Risk Assessment Guidance for Superfund, Volume I. Value is one-tenth of that assumed to occur during a swimming event.

6/22/99

TABLE 5-10
SOIL ADHERANCE FACTORS- OUTDOOR INDUSTRIAL WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Body Part	**Outdoor Industrial Worker Scenario** Surface Area 50th percentile (cm^2) (a)	Soil Loading Groundskeeper (mg/cm^2) (b)	Total Soil Mass (mg)
Head	1,205	0.005	5.543
Hands	904	0.071	64.1485
Forearms	1,230	0.009	11.1438
Total	3,339		80.8
Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area =			0.02

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a), Table 6-12. Average of Groundskeeper Nos. 1,2,3,4, and 5.

TABLE 5-11
SOIL ADHERANCE FACTORS- CONSTRUCTION WORKER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

Body Part	**Construction Worker Scenario** Surface Area 50th percentile (cm^2) (a)	Soil Loading Farmer (mg/cm^2) (a)	Total Soil Mass (mg)
Head	1,205	0.041	49.405
Hands	904	0.47	424.645
Forearms	1,230	0.13	159.9
Total	3,339		634.0
Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area =			0.19

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a), Table 6-12. Average of Farmer Nos. 1 and 2.

TABLE 5-12
SOIL ADHERENCE FACTORS- RESIDENT ADULT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

	Adult Resident		
Body Part	**Surface Area 50th percentile (a) (cm^2)**	**Soil Loading Gardeners (mg/cm^2) (b)**	**Total Soil Mass (mg)**
Hands	904	0.19	171.67
Forearms	1,230	0.052	63.96
Lower legs	2,370	0.047	111.39
Feet	1,225	0.215	347.02
Total	5,729	--	694.03
Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area =			0.12

Notes:
(a) - Data from U.S. EPA (1997a). Tables 6-2, 6-3. Average of 50th percentile values for men and women (1/2 arm used as proxy for female forearm).
(b) - Data from U.S. EPA (1997a) Table 6-12. Average of gardeners Nos. 1 and 2.

TABLE 5-13
SOIL ADHERENCE FACTORS- RESIDENT CHILD
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

	Child Resident (0 to 6 years old)		
Body Part	**Surface Area 50th percentile (a) (cm^2)**	**Soil Loading Day Care Kids (mg/cm^2) (b)**	**Total Soil Mass (mg)**
Hands	358	0.0923	33.04
Forearms	437	0.0230	10.05
Lower legs	812	0.0195	15.83
Feet	451	0.0646	58.93
Total	2,058	--	117.86
Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area =			0.06

Notes:
(a) - Data from U.S. EPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area (6,557 cm2), and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from U.S. EPA (1997a), Table 6-12, Daycare kids Nos. #1a, #1b ,#2c, #3.

TABLE 5-14
SOIL ADHERENCE FACTORS- TRESPASSING TEENAGER (7 TO 18)
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

	Trespassing Teenager (7 to 18)		
Body Part	**Surface Area 50th percentile (a) (cm^2)**	**Soil Loading Soccer Kids (mg/cm^2) (b)**	**Total Soil Mass (mg)**
Hands	715	0.0547	39.09
Forearms	894	0.0061	5.42
Lower legs	2,068	0.0177	36.60
Total	3,677	--	
Area-Weighted Soil Adherence factor (mg/cm2) = Soil mass/Surface area =			0.02

Notes:
(a) - Data from U.S. EPA (1997a). Based on average of boys (Table 6-6) and girls (Table 6-7) total body surface area , and mean percentages of total surface area for individual body parts Table 6-8).
(b) - Data from U.S. EPA (1997a) Table 6-12. Average of Soccer Kids Nos. 1, 2, and 3.

6.0 RISK CHARACTERIZATION

The purpose of the risk characterization is to provide estimates of the potential risk to human health from exposure to COPC at or from the site by receptors at or near the site. To accomplish this objective, this section will include quantitative estimates of potential carcinogenic and noncarcinogenic risk.

The results of the exposure assessment are combined with the results of the dose-response assessment to derive quantitative estimates of risk, or the probability of adverse health effects following assumed potential exposure to the COPCs. Using the exposure point concentrations derived in the exposure assessment, each exposure pathway for each receptor will be evaluated for both potential carcinogenic and noncarcinogenic effects.

6.1 Carcinogenic Risk Characterization

The purpose of carcinogenic risk characterization is to estimate the upper-bound likelihood, over and above the background cancer rate, that a receptor will develop cancer in his or her lifetime as a result of exposure to a chemical in environmental media at the site. This likelihood is a function of the dose of a chemical (described in the Exposure Assessment) and the Cancer Slope Factor (CSF) (described in the Toxicity Assessment) for that chemical. The Excess Lifetime Cancer Risk (ELCR) is the likelihood over and above the background cancer rate, which currently in the U.S. is between 1 in 3 and 1 in 4 (Landis et al., 1998), that an individual will contract cancer in his or her lifetime. The risk value is expressed as a probability (e.g., 10^{-6}, or one in one million). The relationship between the ELCR and the estimated Lifetime Average Daily Dose (LADD) of a chemical may be expressed as:

$$ELCR = 1 - e^{-(CSF \times LADD)}$$

When the product of the CSF and the LADD is much greater than 1, the ELCR approaches 1 (i.e., 100 percent probability). When the product is less than 0.01 (one chance in 100), the equation can be closely approximated by:

$$ELCR = LADD\ (mg/kg\text{-}day) \times CSF\ (mg/kg\text{-}day)^{-1}$$

The product of the CSF and the LADD is unitless, and provides an upper-bound estimate of the potential carcinogenic risk associated with a receptor's exposure to that chemical via that pathway.

The potential carcinogenic risk for each exposure pathway will be calculated for each receptor. In current regulatory risk assessment, it is assumed that cancer risks are additive or cumulative. Pathway and area-specific risks will be summed to estimate the total site potential cancer risk for each information that the risk manager needs to more accurately characterize risks on a site-specific basis and to communicate the nature of the risks to the public.

6.4 Cumulative Risk

Although the AOC SOW identifies separate risk evaluations for groundwater and other media, many potential receptors identified herein are assumed to be exposed to both groundwater and other media simultaneously. To account for cumulative risk, the risk assessment will be conducted for all media, and total site risks will be calculated for each receptor. COC for potentially carcinogenic and noncarcinogenic effects will be identified, and pathways that contribute significantly to target risk exceedances will be identified. RGs will be calculated for appropriate COPC in the appropriate medium. RGs will be presented for COC in groundwater in the RI/FS report, and RGs will be presented for other media in the EE/CA report.

6.5 Uncertainty Analysis

Uncertainty is introduced into the risk assessment in several places throughout the process. Every time an assumption is made, some level of uncertainty is introduced into the risk assessment. In accordance with USEPA guidance (USEPA, 1989a), the uncertainty associated with each step of the risk characterization process will be discussed in this section of the report.

There are many potential sources of uncertainty in the risk assessment process; some are more important than others. The major areas of uncertainty include: the adequacy of the sampling plan, the quality of the analytical data, assumptions about the frequency, duration, and magnitude of exposure, the receptors identified, assumptions made in the modeling performed to predict concentrations at locations where measurement data are lacking, and the availability and accuracy of dose-response data. The uncertainties will be discussed qualitatively in the report, including steps taken to compensate for uncertainty, and the impact on the risk assessment results.

7.0 SUMMARY AND CONCLUSIONS

A summary and conclusions section will contain discussions of the results of the risk assessment. The selection of final COC and the remedial goals for each COC will be presented.

8.0 REFERENCES

ASTM. 1995. Standard Guide for Risk-Based Corrective Action Applied at Petroleum Release Sites. ASTM-1739. American Society for Testing and Materials. Philadelphia, PA.

Baes, C.F., R.D. Sharp, A.L. Sjoreen, and R.W. Shor. 1984. Review and Analysis of Parameters and Assessing Transport of Environmentally Released Radionuclides through Agriculture. Oak Ridge National Laboratory. Oak Ridge, Tennessee.

Calabrese, E.J., R. Barnes, E.J. Stanek, H. Pastides, C.E. Gilbert, P. Veneman, X. Wang, A. Lasztity, and P.T. Kostecki. 1989. How much soil do young children ingest: an epidemiological study. Regul. Toxicol. Pharmacol. 10:123-137.

Calabrese, E.J., E.J. Stanek, C.E. Gilbert, and R.M. Barnes. 1990. Preliminary Adult Soil Ingestion Estimates: Results of a Pilot Study. Reg. Tox. Pharm. 12:88-95.

Clausing, P., B. Brunekreef, and J.H. van Wijnen. 1987. A method for estimating soil ingestion by children. Int. Arch. Occup. Environ. Health. 59:73-82.

Davis, S. P. Waller, R. Buschbom, J. Balloy, and P. White. 1990. Quantitative estimates of soil ingestion in normal children between the ages of 2 and 7 years: Population-based estimates using aluminum, silicon, and titanium as soil tracer elements. Arch. of Environ. Health 45(2):112-122.

Hawley, J.K. 1985. Assessment of health risk from exposure to contaminated soil. Risk Analysis. 5(4):289-302.

Holmes, K.K., J.I. Shirai, K.Y. Richter, and J.C.. Kissel. 1998. Field Measurement of Dermal Soil Loadings in Occupational and Recreational Activities. Environmental Research. In Press.

IEPA. 1998. Tiered Approach to Corrective Action Objectives. Title 35, Subtitle G, Chapter I, Subchapter J, Part 742. As amended June 8, 1998. Illinois Environmental Protection Agency.

Kissel, J.C., K.Y. Richter, and R.A. Fenske. 1996. Field measurement of dermal soil loading attributable to various activities: Implication for exposure assessment. Risk Analysis. 16(1):115-125.

Kissel, J.C., J.H. Shirai, K.Y. Richter, and R.A. Fenske. 1998. Empirical Investigation of Hand-to-Mouth Transfer of Soil. Bull. Environ. Contam. Toxicol. 60:379-386.

Landis, S.H., T. Murray, S. Bolden, and P.A. Wingo. 1998. Cancer Statistics, 1998. CA Cancer J. Clin. 48:6-29. [URL: http://www.ca-journal.org/frames/articles/articles-1998/48_006-029.html]

MADEP. 1995. Guidance for Disposal Site Risk Characterization – In Support of the Massachusetts Contingency Plan. Interim Final. Massachusetts Department of Environmental Protection. Bureau of Waste Site Cleanup and Office of Research and Standards.

NOAA. 1996. Climatic Averages and Extremes for U.S. Cities. National Oceanographic and Atmospheric Administration. June 1996.

NWS. 1986-1995 data on precipitation measured at St. Louis, MO. National Weather Service.

Sheehan, P.J., D.M. Meyer, M.M. Sauer, and D.J. Paustenbach. 1991. Assessment of the Human Health Risks Posed by Exposure to Chromium-Contaminated Soils. J. Toxicol. Environ. Health. 32:161-201.

USEPA. 1989a. Risk Assessment Guidance for Superfund: Volume I. Human Health Evaluation Manual (Part A). Interim Final. Office of Emergency and Remedial Response. U.S. Environmental Protection Agency, Washington, D.C. EPA 540/1-89/002.

USEPA. 1989b. Interim Procedures for Estimating Risk Associated with Mixtures of Chlorinated Dibenzo-p-dioxins and Chlorinated Dibenzofurans (CDDs and CDFs) and 1989 Update. EPA/625/3-89/016. U.S. Environmental Protection Agency, Risk Assessment Forum, Washington, DC.

USEPA. 1991a. Human Health Exposure Manual, Supplemental Guidance; Standard Default Exposure Factors. OSWER Directive No. 9285.6-03. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1992a. Supplemental Guidance to RAGS: Calculating the Concentration Term. Office of Solid Waste and Emergency Response. OSWER Directive No. 9285.7-081. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1992b. Dermal Exposure Assessment: Principles and Applications. Office of Research and Development, Washington, D.C. EPA/600/8-91/011B.

USEPA. 1993a. Selecting Exposure Routes and Contaminants of Concern by Risk-Based Screening. EPA/903/R-93-001. United States Environmental Protection Agency, Region III. Hazardous Waste Management Division. Office of Superfund Programs.

USEPA. 1993b. Superfund's Standard Default Exposure Factors for the Central Tendency and Reasonable Maximum Exposure. Preliminary Review Draft. 5/5/93. U.S. Environmental Protection Agency.

USEPA. 1993c. Air/Superfund national Technical Guidance Study Series: Evaluation of Short-term Air Action Levels for Superfund Sites, EPA-451/R-93-009.

USEPA. 1995a. Land Use in the CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04. U.S. Environmental Protection Agency. Washington, DC.

USEPA. 1995b. Compilation of Air Pollutant Emission Factors. Volume I: Stationary Point and the Area Source. 4th Edition. PB86-124906.

USEPA. 1996a. Soil Screening Guidance: Technical Background Document. EPA/540/R-95/128. Office of Solid Waste and Emergency Response. U.S. Environmental Protection Agency, Washington DC.

USEPA. 1996b. Office of Technical Service Supplemental Guidance to RAGS: Region 4 Bulletins. United States Environmental Protection Agency, Region 4. Waste Management Division. Atlanta, GA.

USEPA. 1997a. Exposure Factors Handbook, Volumes I, II and III. EPA/600/P-95/002F. Office of Research and Development. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1997b. Health Effects Assessment Summary Tables (HEAST). EPA 540-R-94-020. Office of Research and Development. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1997c. User's Guide for the Johnson and Ettinger (1991) Model for Subsurface Vapor Intrusion into Buildings. Prepared By Environmental Quality Management, Inc. for E.H. Pechan and Associates, Inc. for Submittal to Janine Dinan, Work Assignment Manager. Office of Emergency and Remedial Response. Toxics Integration Branch. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1998a. Risk Assessment Guidance for Superfund: Volume I. Human Health Evaluation Manual (Part D, Standardized Planning, Reporting, and Review of Superfund Risk Assessments). Interim. 9285.7-01D. Office of Emergency and Remedial Response. U.S. Environmental Protection Agency. Washington, DC.

USEPA. 1998b. U.S. Environmental Protection Agency Region 5, Model QAPP (Quality Assurance and Project Plan). May, 1998.

USEPA. 1998c. Preliminary Remediation Goals (PRGs). Waste Programs, U.S. Environmental Protection Agency, Region 9. San Francisco, California. June 3, 1998. [URL: www.epa.gov/region09/waste/sfund/prg/index.html]

USEPA, 1998d. National Recommended Water Quality Criteria. Federal Register, Vol. 63, No. 237 pages 68354-68364. Thursday December 10, 1998.

USEPA. 1998e. Risk-Based Concentration Table. Superfund Technical Support Section. U.S Environmental Protection Agency, Region III, Philadelphia, PA. October 1998. [URL: http:\\www.epa.gov/reg3hwmd/riskmenu.htm]

USEPA. 1998f. Disposal of Polychlorinated Biphenyls (PCBs); Final Rule. FR63(124):35384-35474. June 29, 1998.

USEPA. 1998g. Approach for Addressing Dioxin in Soil at CERCLA and RCRA Sites. OSWER Directive 9200.4-26. April 13, 1998. U.S. Environmental Protection Agency, Washington, D.C.

USEPA. 1999. Integrated Risk Information System (IRIS). Environmental Criteria and Assessment Office. U.S. Environmental Protection Agency, Cincinnati, OH.
[URL: http:\\www.epa.gov/ngispgm3/iris]

Van den Berg, M., L. Birnbaum, A.T.C. Bosveld, B. Brunstrom, P. Cook, M. Freeley, J.P. Giesy, A. Hanberg, R. Hasegawa, S.W. Kennedy, T. Kubiak, J.C. Larsen, F.X. Rolaf van Leeuwen, A.K.D Liem, C. Nolt, R.E. Peterson, L. Poellinger, S. Safe, D. Schrenk, D. Tillitt, M. Tysklind, M. Younes, F. Waern, And T. Zacharewski. Toxic Equivalency Factors (TEFs) for PCBs, PCDDs, and PCDFs for Humans and Wildlife. Environmental Health Perspectives. 106(12):775-792.

APPENDIX A

DATA QUALITY LEVELS FOR HUMAN HEALTH RISK ASSESSMENT

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (q)	Basis
TCL Volatiles			
1,1,1-Trichloroethane	71-55-6	2.00E+00	A
1,1,2,2-Tetrachloroethane	79-34-5	3.60E-01	F
1,1,2-Trichloroethane	79-00-5	2.00E-02	A
1,1-Dichloroethane	75-34-3	1.77E+00	B
1,1-Dichloroethylene	75-35-4	4.62E-03	B
1,2-Dichloroethane	107-06-2	2.00E-02	A
1,2-Dichloroethylene (total)	540-59-0	3.64E-02	B
1,2-Dichloropropane	78-87-5	1.00E-02	B
2-Butanone	78-93-3	6.90E+03	E
2-Hexanone	591-78-6	7.50E+02 (m)	E
4-Methyl-2-pentanone	108-10-1	7.50E+02	E
Acetone	67-64-1	1.23E+00	B
Benzene	71-43-2	3.00E-02	A
Bromodichloromethane	75-27-4	6.00E-01	A
Bromoform	75-25-2	8.00E-01	A
Bromomethane	74-83-9	3.80E+00	E
Carbon Disulfide	75-15-0	4.57E+00	B
Carbon tetrachloride	56-23-5	7.00E-02	A
Chlorobenzene	108-90-7	7.69E-02	B
Chloroethane	75-00-3	1.53E+02 (p)	F
Chloroform	67-66-3	3.00E-01	C
Chloromethane	74-87-3	1.20E+00	F
cis-1,3-Dichloropropene	10061-01-5	4.00E-03	A
Dibromochloromethane	124-48-1	4.00E-01	A
Ethyl Benzene	100-41-4	1.00E+00	B
Methylene chloride	75-09-2	2.00E-02	A
Styrene	100-42-5	3.08E-01	B
Tetrachloroethene	127-18-4	6.00E-02	A
Toluene	108-88-3	9.23E-01	B
Total Xylenes	1330-20-7	2.11E+01 (d)	B
trans-1,3-Dichloropropene	10061-02-6	4.00E-03	A
Trichloroethene	79-01-6	6.00E-02	A
Vinyl chloride	75-01-4	1.00E-02	A
TCL Semi-Volatiles			
1,2,4-Trichlorobenzene	120-82-1	2.50E+00	B
1,2-Dichlorobenzene	95-50-1	1.70E+01	A
1,3-Dichlorobenzene	541-73-1	2.00E+00 (e)	A
1,4-Dichlorobenzene	106-46-7	2.00E+00	A
2,2'-oxybis(1-Chloropropane)	108-60-1	2.54E+00	F
2,4,5-Trichlorophenol	95-95-4	6.40E+01	H
2,4,6-Trichlorophenol	88-06-2	7.00E-02	H
2,4-Dichlorophenol	120-83-2	6.90E-01	H
2,4-Dimethylphenol	105-67-9	9.00E-01	B
2,4-Dinitrophenol	51-28-5	1.10E+02	E
2,4-Dinitrotoluene	121-14-2	8.00E-04	A
2,6-Dinitrotoluene	606-20-2	7.00E-04	A
2-Chloronaphthalene	91-58-7	3.70E+03	E
2-Chlorophenol	95-57-8	3.10E+00	H
2-Methylnaphthalene	91-57-6	8.40E+01	A
2-Methylphenol	95-48-7	1.67E+00	B
2-Nitroaniline	88-74-4	3.30E+00	E
2-Nitrophenol	88-75-5	3.40E+03 (n)	E
3,3'-Dichlorobenzidine	91-94-1	7.00E-03	A
3-Nitroaniline	99-09-2	3.30E+00 (o)	E
4,6-Dinitro-2-methylphenol	534-52-1	NA	K
4-Bromophenyl phenyl ether	101-55-3	NA	K

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (q)		Basis
4-Chloraniline	106-47-8	3.50E-01		B
4-Chloro-3-methylphenol	59-50-7	NA		K
4-Chlorophenol phenyl ether	7005-72-3	NA		K
4-Methylphenol	106-44-5	1.67E+00	(g)	B
4-Nitroaniline	100-01-6	3.30E+00	(o)	E
4-Nitrophenol	100-02-7	3.40E+03		E
Acenaphthene	83-32-9	4.38E+01		B
Acenaphthylene	208-96-8	4.38E+01	(h)	B
Anthracene	120-12-7	1.20E+04		A
Benz[a]anthracene	56-55-3	9.00E-01		D
Benzo[a]pyrene	50-32-8	9.00E-02		D
Benzo[b]fluoranthene	205-99-2	9.00E-01		D
Benzo[g,h,i]perylene	191-24-2	1.77E+02	(a)	B,D
Benzo[k]fluoranthene	207-08-9	9.00E+00		D
bis(2-Chloroethoxy)methane	111-91-1	NA		K
bis(2-Chloroethyl)ether	111-44-4	4.00E-04		A
bis(2-Ethylhexyl)phthalate	117-81-7	4.60E+01		A
Butyl benzyl phthalate	85-68-7	9.30E+02		A
Carbazole	86-74-8	6.00E-01		A
Chrysene	218-01-9	8.80E+01		D
Dibenz[a,h]anthracene	53-70-3	9.00E-02		D
Dibenzofuran	132-64-9	2.10E+02		E
Diethylphthalate	84-66-2	4.70E+02		A
Dimethyl phthalate	131-11-3	1.00E+05		G
Di-n-butyl phthalate	84-74-2	2.30E+03		A
Di-n-octyl phthalate	117-84-0	1.23E+02		B,D
Fluoranthene	206-44-0	2.38E+02		B,D
Fluorene	86-73-7	5.60E+01		B
Hexachlorobenzene	118-74-1	7.00E-02		D
Hexachlorobutadiene	87-68-3	5.70E+00		F
Hexachlorocyclopentadiene	77-47-4	3.33E+00		B,C
Hexachloroethane	67-72-1	5.00E-01		A
Indeno[1,2,3-cd]pyrene	193-39-5	9.00E-01		D
Isophorone	78-59-1	8.00E+00		A
Naphthalene	91-20-3	8.40E+01		
Nitrobenzene	98-95-3	7.69E-03		B
N-Nitroso-di-n-propylamine	621-64-7	5.00E-05		A
N-Nitrosodiphenylamine	86-30-6	1.00E+00		A
Pentachlorophenol	87-86-5	2.00E-02		H
Phenanthrene	85-01-8	1.20E+04	(b)	A
Phenol	108-95-2	1.43E+01		B
Pyrene	129-00-0	1.77E+02		B,D
TAL Metals				
Aluminum	7429-90-5	7.50E+04		E
Antimony	7440-36-0	5.00E+00		H
Arsenic	7440-38-2	4.00E-01		D
Barium	7440-39-3	2.60E+02		H
Beryllium	7440-41-7	1.00E-01		D
Cadmium	7440-43-9	1.00E+00		H
Calcium	7440-70-2	NA		J
Chromium	7440-47-3	2.80E+01	(c)	H
Cobalt	7440-48-4	4.70E+03		D

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (q)	Basis
Iron	7439-89-6	2.20E+04	E
Lead	7439-92-1	4.00E+02	D
Magnesium	7439-95-4	NA	J
Manganese	7439-96-5	4.11E+02	D
Mercury	7439-97-6	1.00E-01	H
Nickel	7440-02-0	2.00E+01	C
Potassium	7440-09-7	NA	J
Selenium	7782-49-2	2.40E+00	H
Silver	7440-22-4	2.40E-01	H
Sodium	7440-23-5	NA	J
Thallium	7440-28-0	1.60E+00	H
Vanadium	7440-62-2	5.50E+02	D
Copper	7440-50-8	3.30E+02	H
Zinc	7440-66-6	1.00E+03	H
Cyanide	57-12-5	4.00E+01	H
Pesticides			
Alpha-BHC	319-84-6	5.00E-04	A
Beta-BHC	319-85-7	5.00E-04 (j)	A
Delta-BHC	319-86-8	5.00E-04 (j)	A
Gamma-BHC (Lindane)	58-89-9	9.00E-03	A
Aldrin	309-00-2	4.00E-02	D
alpha-Chlordane	5103-71-9	5.00E-01 (i)	D
gamma-Chlordane	5103-74-2	5.00E-01 (i)	D
Chlordane	57-74-9	5.00E-01	D
Chlorobenzilate	510-15-6	1.60E+00	F
1,2-Dibromo-3-Chloropropane	96-12-8	2.00E-03	A
4,4'-DDD	72-54-8	3.00E+00	D

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (q)		Basis
4,4'-DDE	72-55-9	2.00E+00		D
4,4'-DDT	50-29-3	2.00E+00		D
Diallate	2303-16-4	7.30E+00		F
Dieldrin	60-57-1	4.00E-03		A
Endosulfan I	959-98-8	1.38E+00	(k)	B
Endosulfan II	33213-65-9	1.38E+00	(k)	B
Endosulfan sulfate	1031-07-8	1.38E+00	(k)	B
Endrin	72-20-8	7.69E-02		B
Endrin aldehyde	7421-93-4	7.69E-02	(l)	B
Endrin Ketone	53494-70-5	7.69E-02	(l)	B
Heptachlor	76-44-8	1.00E-01		C,D
Heptachlor epoxide	1024-57-3	7.00E-02		D
Hexachlorobenzene	118-74-1	4.00E-01		D
Hexachlorocyclopentadiene	77-47-4	3.33E+00		B,C
Isodrin	465-73-6	NA		K
Methoxychlor	72-43-5	2.29E+01		B
Toxaphene	8001-35-2	6.00E-01		D
Herbicides				
2,4-D	94-75-7	1.36E-01		B
2,4-DB	94-82-6	4.40E+02		E
2,4,5-TP	93-72-1	1.10E+01		H
2,4,5-T	93-76-5	7.82E+02	(p)	E
Dalapon	75-99-0	6.54E-02		B
Dicamba	1918-00-9	1.60E+03		E
Dichloroprop	120-36-5	NA		K
Dinoseb	88-85-7	2.50E-01		H
MCPA	94-74-6	3.91E+01	(p)	E
MCPP	93-65-2	7.82E+01	(p)	E
4-Nitrophenol	100-02-7	3.40E+03		E
Pentachlorophenol	87-86-5	2.00E-02		H
Dioxins and Furans				
2,3,7,8-TCDD	1746-01-6	1.00E-03		I
1,2,3,7,8-PentaCDD	40321-76-4	1.00E-03		I
1,2,3,4,7,8-HexaCDD	39227-28-6	1.00E-03		I
1,2,3,6,7,8-HexaCDD	57653-85-7	1.00E-03		I
1,2,3,7,8,9-HexaCDD	19408-74-3	1.00E-03		I
1,2,3,4,6,7,8-HeptaCDD	35822-39-4	1.00E-03		I
OctaCDD	3268-87-9	1.00E-03		I
2,3,7,8-TetraCDF	51207-31-9	1.00E-03		I
1,2,3,7,8-PentaCDF	57117-41-6	1.00E-03		I
2,3,4,7,8-PentaCDF	57117-31-4	1.00E-03		I
1,2,3,4,7,8-HexaCDF	70648-26-9	1.00E-03		I
1,2,3,6,7,8-HexaCDF	57117-44-9	1.00E-03		I
1,2,3,7,8,9-HexaCDF	72918-21-9	1.00E-03		I
2,3,4,6,7,8-HexaCDF	60851-34-5	1.00E-03		I
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	1.00E-03		I
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	1.00E-03		I
OctaCDF	39001-02-0	1.00E-03		I

TABLE 1
DATA QUALITY LIMITS (DQLs) FOR SOIL AND SEDIMENT
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (q)	Basis
TPH			
GRO	NA	5.00E+00	L
DRO	NA	4.00E+00	L
Additional (added 4/17/99)			
Copper,method 7211	7440-50-8	3.30E+02	H
Zinc, method 7151	7440-66-6	1.00E+03	H
TOC, method 9060	NA	NA	K
TPH, method 8015B	NA	5.00E+00	L
Naphthalene	91-20-3	8.40E+01	B
Total PCBs	NA	1.00E+00	M

Notes:
(a) Due to structural similarities, the value for Pyrene was used.
(b) Due to structural similarities, the value for Anthracene was used.
(c) Value for Chromium IV.
(d) Value for o-Xylene.
(e) IEPA, 1998, No Appendix Table B value available, therefore, due to structural similarities, value for 1,2-Dichlorobenene used.
(f) Due to structural similarities, the value for Naphthalene was used.
(g) Due to structural similarities, the value for 2-Methylphenol was used.
(h) Due to structural similarities, the value for Acenaphthene was used.
(i) Due to structural similarities, the value for Chlordane was used.
(j) Due to structural similarities, the value for alpha-BHC was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Due to structural similarities, the value for 4-Methyl 2-Pentanone was used.
(n) Due to structural similarities, the value for 4-Nitrophenol was used.
(o) Due to structural similarities, the value for 2-Nitroaniline was used.
(p) PRG calculated based on equations in PRG table.
(q) - The following hierarchy was used to determine the appropriate DQL:
1. The lower of Illinois Tiered Approach to Corrective Action (TACO) Program Tier 1 values from Appendix B, Table C or Appendix B, Table A, with adjustmentsmade for additivity for noncarcinogens.
2. For constituents not listed on Appendix B, Table A, Region IX PRGs for residential soil were used.

CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA - Not Available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
TAL = Target Analyte List.
TCL = Target Compound List.
TPH = Total Petroleum Hydrocarbons.
A = IEPA, 1998, Appendix B, Table A, Value for Class I Groundwater.
B = IEPA, 1998, Appendix B, Table A, Value for Class I Groundwater adjusted for additivity of noncarcinogenic effects.
C = IEPA, 1998, Appendix B, Table A, Value for Inhalation.
D = IEPA, 1998, Appendix B, Table A, Value for Ingestion.
E = Region IX PRG based on noncarcinogenic effects.
F = Region IX PRG based on carcinogenic effects.
G = Region IX PRG based on ceiling limit.
H = IEPA, 1998, Appendix B, Table C. Lowest value was selected.
I = USEPA, 1998g. Value for Dioxins.
J = No value is available as this constituent is an essential nutrient.
K = No toxicity information is available for this constituent therefore DQL was not developed.
L = Estimated data quality limits based on previous testing.
M = USEPA, 1998f. PCB Mega Rule.

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	Surface Water (m) DQL (mg/L)	Ground Water (a) DQL (mg/L)		Ground Water (a) Basis	Selected DQL (p) (mg/L)
TCL Volatiles						
1,1,1-Trichloroethane	71-55-6	NA	0.2		B	2.00E-01
1,1,2,2-Tetrachloroethane	79-34-5	0.011	0.000055		C (ca)	5.50E-05
1,1,2-Trichloroethane	79-00-5	0.042	0.005		B	5.00E-03
1,1-Dichloroethane	75-34-3	NA	0.7		B	7.00E-01
1,1-Dichloroethylene	75-35-4	0.0032	0.007		B	3.20E-03
1,2-Dichloroethane	107-06-2	0.099	0.00003		A	3.00E-05
1,2-Dichloroethylene (total)	540-59-0	140	0.07	(c)	B	7.00E-02
1,2-Dichloropropane	78-87-5	0.039	0.005		B	5.00E-03
2-Butanone	78-93-3	NA	1.9		C (nc)	1.90E+00
2-Hexanone	591-78-6	NA	0.16	(g)	C (nc)	1.60E-01
4-Methyl-2-pentanone	108-10-1	NA	0.16		C (nc)	1.60E-01
Acetone	67-64-1	NA	0.7		B	7.00E-01
Benzene	71-43-2	0.071	0.005		B	5.00E-03
Bromodichloromethane	75-27-4	0.046	0.00002		B	2.00E-05
Bromoform	75-25-2	0.36	0.0002		B	2.00E-04
Bromomethane	74-83-9	NA	0.0098		B	9.80E-03
Carbon Disulfide	75-15-0	NA	0.7		B	7.00E-01
Carbon tetrachloride	56-23-5	0.0044	0.00003		A	3.00E-05
Chlorobenzene	108-90-7	21	0.1		B	1.00E-01
Chloroethane	75-00-3	NA	1.26E+01	(o)	C (ca)	1.26E+01
Chloroform	67-66-3	0.47	0.00002		B	2.00E-05
Chloromethane	74-87-3	NA	0.0015		C (ca)	1.50E-03
cis-1,3-Dichloropropene	10061-01-5	1.7	0.001		B	1.00E-03
Dibromochloromethane	124-48-1	0.034	0.14		B	3.40E-02
Ethyl Benzene	100-41-4	29	0.7		B	7.00E-01
Methylene chloride	75-09-2	1.6	0.005		B	5.00E-03
Styrene	100-42-5	NA	0.1		B	1.00E-01
Tetrachloroethene	127-18-4	0.00885	0.00001		A	1.00E-05
Toluene	108-88-3	200	1		B	1.00E+00
Total Xylenes	1330-20-7	NA	10		B	1.00E+01
trans-1,3-Dichloropropene	10061-02-6	1.7	0.001		B	1.00E-03
Trichloroethene	79-01-6	0.081	0.005		B	5.00E-03
Vinyl chloride	75-01-4	0.525	0.00006		A	6.00E-05
TCL Semi-Volatiles						
1,2,4-Trichlorobenzene	120-82-1	0.94	0.07		B	7.00E-02
1,2-Dichlorobenzene	95-50-1	17	0.6		B	6.00E-01
1,3-Dichlorobenzene	541-73-1	2.6	0.075		B	7.50E-02
1,4-Dichlorobenzene	106-46-7	2.6	0.075		B	7.50E-02
2,2'-oxybis(1-Chloropropane)	108-60-1	170	0.00027		C (ca)	2.70E-04
2,4,5-Trichlorophenol	95-95-4	9.8	0.7		B	7.00E-01
2,4,6-Trichlorophenol	88-06-2	0.0065	0.0064		B	6.40E-03
2,4-Dichlorophenol	120-83-2	0.79	0.021		B	2.10E-02
2,4-Dimethylphenol	105-67-9	2.3	0.14		B	1.40E-01
2,4-Dinitrophenol	51-28-5	14	0.014		B	1.40E-02
2,4-Dinitrotoluene	121-14-2	0.0091	0.00002		B	2.00E-05
2,6-Dinitrotoluene	606-20-2	NA	0.0001		B	1.00E-04
2-Chloronaphthalene	91-58-7	4.3	0.49		C (nc)	4.90E-01
2-Chlorophenol	95-57-8	0.4	0.035		B	3.50E-02
2-Methylnaphthalene	91-57-6	NA	0.025	(d)	B	2.50E-02
2-Methylphenol	95-48-7	NA	0.35		B	3.50E-01
2-Nitroaniline	88-74-4	NA	2.2		C (nc)	2.20E+00
2-Nitrophenol	88-75-5	NA	2.3	(h)	C (nc)	2.30E+00
3,3'-Dichlorobenzidine	91-94-1	0.000077	0.02		A	7.70E-05
3-Nitroaniline	99-09-2	NA	0.0022	(i)	C (nc)	2.20E-03

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	Surface Water (m) DQL (mg/L)		Ground Water (a) DQL (mg/L)		Basis	Selected DQL (p) (mg/L)
4,6-Dinitro-2-methylphenol	534-52-1	0.765		NA		E	7.65E-01
4-Bromophenyl phenyl ether	101-55-3	NA		NA		E	NA
4-Chloraniline	106-47-8	NA		0.028		B	2.80E-02
4-Chloro-3-methylphenol	59-50-7	NA		NA		E	NA
4-Chlorophenol phenyl ether	7005-72-3	NA		NA		E	NA
4-Methylphenol	106-44-5	NA		0.35		B	3.50E-01
4-Nitroaniline	100-01-6	NA		0.0022	(i)	C (nc)	2.20E-03
4-Nitrophenol	100-02-7	NA		2.3		C (nc)	2.30E+00
Acenaphthene	83-32-9	2.7		0.42		B	4.20E-01
Acenaphthylene	208-96-8	2.7	(b)	0.42	(b)	B	4.20E-01
Anthracene	120-12-7	110		2.1		B	2.10E+00
Benz[a]anthracene	56-55-3	0.000049		0.00013		B	4.90E-05
Benzo[a]pyrene	50-32-8	0.000049		0.00023		A	4.90E-05
Benzo[b]fluoranthene	205-99-2	0.000049		0.00018		B	4.90E-05
Benzo[g,h,i]perylene	191-24-2	NA		0.21	(e)	B	2.10E-01
Benzo[k]fluoranthene	207-08-9	0.000049		0.00017		B	4.90E-05
bis(2-Chloroethoxy)methane	111-91-1	NA		NA		E	NA
bis(2-Chloroethyl)ether	111-44-4	0.0014		0.01		A	1.40E-03
bis(2-Ethylhexyl)phthalate	117-81-7	0.0059		0.006		B	5.90E-03
Butyl benzyl phthalate	85-68-7	5.2		1.4		B	1.40E+00
Carbazole	86-74-8	NA		0.0034		C (ca)	3.40E-03
Chrysene	218-01-9	0.000049		0.0015		B	4.90E-05
Dibenz[a,h]anthracene	53-70-3	0.000049		0.0003		A	4.90E-05
Dibenzofuran	132-64-9	NA		0.024		C (nc)	2.40E-02
Diethylphthalate	84-66-2	120		5.6		B	5.60E+00
Dimethyl phthalate	131-11-3	2900		370		C (nc)	3.70E+02
Di-n-butyl phthalate	84-74-2	12		0.7		B	7.00E-01
Di-n-octyl phthalate	117-84-0	NA		0.14		B	1.40E-01
Fluoranthene	206-44-0	0.37		0.28		B	2.80E-01
Fluorene	86-73-7	14		0.28		B	2.80E-01
Hexachlorobenzene	118-74-1	0.00000077		0.00006		A	7.70E-07
Hexachlorobutadiene	87-68-3	0.05		0.00086		C (ca)	8.60E-04
Hexachlorocyclopentadiene	77-47-4	17		0.05		B	5.00E-02
Hexachloroethane	67-72-1	0.0089		0.007		B	7.00E-03
Indeno[1,2,3-cd]pyrene	193-39-5	0.000049		0.00043		B	4.90E-05
Isophorone	78-59-1	2.6		1.4		B	1.40E+00
Naphthalene	91-20-3	NA		0.025		B	2.50E-02
Nitrobenzene	98-95-3	1.9		0.0035		B	3.50E-03
N-Nitroso-di-n-propylamine	621-64-7	0.0014		0.01		A	1.40E-03
N-Nitrosodiphenylamine	86-30-6	0.016		0.01		B	1.00E-02
Pentachlorophenol	87-86-5	0.0082		0.001		A	1.00E-03
Phenanthrene	85-01-8	110	(f)	2.1	(f)	B	2.10E+00
Phenol	108-95-2	4600		0.1		B	1.00E-01
Pyrene	129-00-0	11		0.21		B	2.10E-01

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	Surface Water (m) DQL (mg/L)		Ground Water (a) DQL (mg/L)		Ground Water (a) Basis	Selected DQL (p) (mg/L)
TAL Metals							
Aluminum	7429-90-5	NA		37		C (nc)	3.70E+01
Antimony	7440-36-0	4.3		0.006		B	6.00E-03
Arsenic	7440-38-2	0.00014		0.001		A	1.40E-04
Barium	7440-39-3	NA		2		B	2.00E+00
Beryllium	7440-41-7	NA		0.004		A	4.00E-03
Cadmium	7440-43-9	NA		0.005		B	5.00E-03
Calcium	7440-70-2	NA		NA		F	NA
Chromium	7440-47-3	NA		0.1		B	1.00E-01
Cobalt	7440-48-4	NA		1		B	1.00E+00
Iron	7439-89-6	NA		5		B	5.00E+00
Lead	7439-92-1	NA		0.0075		B	7.50E-03
Magnesium	7439-95-4	NA		NA		F	NA
Manganese	7439-96-5	0.1		0.15		B	1.00E-01
Nickel	7440-02-0	4.6		0.1		B	1.00E-01
Potassium	7440-09-7	NA		NA		F	NA
Selenium	7782-49-2	11		0.05		B	5.00E-02
Silver	7440-22-4	NA		0.05		B	5.00E-02
Sodium	7440-23-5	NA		NA		F	NA
Thallium	7440-28-0	0.0063		0.002		B	2.00E-03
Vanadium	7440-62-2	NA		0.049		B	4.90E-02
Mercury	7439-97-6	0.000051		0.002		B	5.10E-05
Copper	7440-50-8	NA		0.65		B	6.50E-01
Zinc	7440-66-6	69		5		B	5.00E+00
Cyanide	57-12-5	220		0.2		B	2.00E-01
Pesticides							
Alpha-BHC	319-84-6	0.000013		0.00003		A	1.30E-05
Beta-BHC	319-85-7	0.000046		0.00003	(n)	A	3.00E-05
Delta-BHC	319-86-8	NA		0.00003	(n)	A	3.00E-05
Gamma-BHC (Lindane)	58-89-9	0.000063		0.0002		B	6.30E-05
Aldrin	309-00-2	0.00000014		0.00004		A	1.40E-07
alpha-Chlordane	5103-71-9	0.0000022	(j)	0.00014	(j)	A	2.20E-06
gamma-Chlordane	5103-74-2	0.0000022	(j)	0.00014	(j)	A	2.20E-06
Chlordane	57-74-9	0.0000022		0.00014		A	2.20E-06
Chlorobenzilate	510-15-6	NA		0.00025		C (ca)	2.50E-04
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	NA		0.002		A	2.00E-03
4,4'-DDD	72-54-8	0.00000084		0.00011		B	8.40E-07
4,4'-DDE	72-55-9	0.00000059		0.00004		B	5.90E-07
4,4'-DDT	50-29-3	0.00000059		0.00012		B	5.90E-07
Diallate	2303-16-4	NA		0.0011		C (ca)	1.10E-03
Dieldrin	60-57-1	0.00000014		0.00002		A	1.40E-07
Endosulfan I	959-98-8	0.24		0.042	(k)	B	4.20E-02
Endosulfan II	33213-65-9	0.24		0.042	(k)	B	4.20E-02
Endosulfan sulfate	1031-07-8	0.24		0.042	(k)	B	4.20E-02
Endrin	72-20-8	0.00081		0.002		B	8.10E-04
Endrin aldehyde	7421-93-4	0.00081		0.002	(l)	B	8.10E-04
Endrin Ketone	53494-70-5	0.00081	(l)	0.002	(l)	B	8.10E-04
Heptachlor	76-44-8	0.00000021		0.00003		A	2.10E-07
Heptachlor epoxide	1024-57-3	0.00000011		0.00032		A	1.10E-07
Hexachlorobenzene	118-74-1	0.00000077		0.00006		A	7.70E-07
Hexachlorocyclopentadiene	77-47-4	17		0.05		B	5.00E-02
Isodrin	465-73-6	NA		NA		E	NA
Methoxychlor	72-43-5	NA		0.04		B	4.00E-02
Toxaphene	8001-35-2	0.00000075		0.00086		A	7.50E-07

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	Surface Water (m) DQL (mg/L)	Ground Water (a) DQL (mg/L)		Ground Water (a) Basis	Selected DQL (p) (mg/L)
Herbicides						
2,4-D	94-75-7	NA	0.07		B	7.00E-02
2,4-DB	94-82-6	NA	2.92E+02	(o)	C (nc)	2.92E+02
2,4,5-TP	93-72-1	NA	0.05		B	5.00E-02
2,4,5-T	93-76-5	NA	7.82E+02	(o)	C (nc)	7.82E+02
Dalapon	75-99-0	NA	0.2		B	2.00E-01
Dicamba	1918-00-9	NA	1.1		C (nc)	1.10E+00
Dichloroprop	120-36-5	NA	NA		E	NA
Dinoseb	88-85-7	NA	0.007		B	7.00E-03
MCPA	94-74-6	NA	1.83E+01	(o)	C (nc)	1.83E+01
MCPP	93-65-2	NA	3.65E+01	(o)	C (nc)	3.65E+01
4-Nitrophenol	100-02-7	NA	2.3		C (nc)	2.30E+00
Pentachlorophenol	87-86-5	0.0082	0.001		A	1.00E-03
Dioxins and Furans						
2,3,7,8-TCDD	1746-01-6	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,7,8-PentaCDD	40321-76-4	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,4,7,8-HexaCDD	39227-28-6	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,6,7,8-HexaCDD	57653-85-7	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,7,8,9-HexaCDD	19408-74-3	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,4,6,7,8-HeptaCDD	35822-39-4	1.40E-11	4.50E-07		C	1.40E-11
OctaCDD	3268-87-9	1.40E-11	4.50E-07		C	1.40E-11
2,3,7,8-TetraCDF	51207-31-9	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,7,8-PentaCDF	57117-41-6	1.40E-11	4.50E-07		C	1.40E-11
2,3,4,7,8-PentaCDF	57117-31-4	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,4,7,8-HexaCDF	70648-26-9	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,6,7,8-HexaCDF	57117-44-9	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,7,8,9-HexaCDF	72918-21-9	1.40E-11	4.50E-07		C	1.40E-11
2,3,4,6,7,8-HexaCDF	60851-34-5	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	1.40E-11	4.50E-07		C	1.40E-11
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	1.40E-11	4.50E-07		C	1.40E-11
OctaCDF	39001-02-0	1.40E-11	4.50E-07		C	1.40E-11

TABLE 2
DATA QUALITY LIMITS (DQLs) FOR SURFACE WATER AND GROUNDWATER
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	Surface Water (m) DQL (mg/L)	Ground Water (a) DQL (mg/L)	Ground Water (a) Basis	Selected DQL (p) (mg/L)
Additional (added 4/17/99)					
Copper, method 7211	7440-50-8	NA	6.50E-01	B	6.50E-01
Zinc, method 7151	7440-66-6	6.90E+01	5.00E+00	B	5.00E+00
TOC, method 9060	NA	NA	NA	E	NA
Hardness, method 130.1	NA	NA	NA	E	NA
TPH, method 8015B	NA	NA	NA	E	NA
Residue, dissolved	NA	NA	NA	E	NA
Residue, suspended	NA	NA	NA	E	NA
Total PCBs	NA	1.70E-07	5.00E-04	B	1.70E-07
Fluoride	7782-41-4	NA	(q)		NA
Phosphorous	7723-14-0	NA	(q)		NA
Ortho-phosphate	NA	NA	(q)		NA

Notes:
(a) - The following hierarchy was used to determine the appropriate DQL:
1. ADL value from Appendix A Table H from the Illinois Tiered Approach to Corrective Action (TACO) Program.
2. For constituents not on Table H, the value for Class I GW from Appendix B Table E was used.
3. For constituents with no TACO values, the Region IX PRG for tap water was used.
4. For remaining constituents, a default value equivalent to the lowest DQL for that type of constituent was used.
(b) Due to structural similarities, the value for Acenaphthene was used.
(c) Value for cis-1,2-Dichloroethylene.
(d) Due to structural similarities, the value for Naphthalene was used.
(e) Due to structural similarities, the value for Pyrene was used.
(f) Due to structural similarities, the value for Anthracene was used.
(g) Due to structural similarities, the value for 4-Methyl-2-Pentanone was used.
(h) Due to structural similarities, the value for 4-Nitrophenol was used.
(i) Due to structural similarities, the value for 2-Nitroaniline was used.
(j) Due to structural similarities, the value for Chlordane was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Surface Water Values were obtained from Federal Register, Vol. 63, No. 237. Value for Human Health Consumption of Organisms.
(n) Due to structural similarities, the value for alpha-BHC was used.
(o) PRG calculated based on equations in PRG table.
(p) - Selected DQL is the lower of the surface water and groundwater DQLs.
(q) - Constituent will not be analyzed for in groundwater.
nc - Based on noncarcinogenic effects.
ca - Based on carcinogenic effects.
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
TAL = Target Analyte List.
TCL = Target Compound List.
A = IEPA, 1998, Appendix A, Table H, Acceptable Detection Limit (ADL) Value.
B = IEPA, 1998, Appendix B, Table E, Value for Class I Groundwater.
C = Region IX PRG.
D = Default Value based on lowest DQL.
E = No toxicity information is available for this constituent therefore DQL was not developed.
F = No value is available as this constituent is an essential nutrient.

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg)	(n)	Basis
TCL Semi-Volatiles				
1,2,4-Trichlorobenzene	120-82-1	14		N
1,2-Dichlorobenzene	95-50-1	120		N
1,3-Dichlorobenzene	541-73-1	41		N
1,4-Dichlorobenzene	106-46-7	0.13		C
2,2'-oxybis(1-Chloropropane)	108-60-1	0.045	(m)	C
2,4,5-Trichlorophenol	95-95-4	140		N
2,4,6-Trichlorophenol	88-06-2	0.29		C
2,4-Dichlorophenol	120-83-2	4.1		N
2,4-Dimethylphenol	105-67-9	27		N
2,4-Dinitrophenol	51-28-5	2.7		N
2,4-Dinitrotoluene	121-14-2	2.7		N
2,6-Dinitrotoluene	606-20-2	1.4		N
2-Chloronaphthalene	91-58-7	110		N
2-Chlorophenol	95-57-8	6.8		N
2-Methylnaphthalene	91-57-6	27		N
2-Methylphenol	95-48-7	68		N
2-Nitroaniline	88-74-4	NA		O
2-Nitrophenol	88-75-5	11	(a)	N
3,3'-Dichlorobenzidine	91-94-1	0.007		C
3-Nitroaniline	99-09-2	NA		O
4,6-Dinitro-2-methylphenol	534-52-1	NA		D
4-Bromophenyl phenyl ether	101-55-3	NA		D
4-Chloraniline	106-47-8	5.4		N
4-Chloro-3-methylphenol	59-50-7	NA		D
4-Chlorophenol phenyl ether	7005-72-3	NA		D
4-Methylphenol	106-44-5	6.8		N
4-Nitroaniline	100-01-6	NA		O
4-Nitrophenol	100-02-7	11		N
Acenaphthene	83-32-9	81		N
Acenaphthylene	208-96-8	81	(b)	N
Anthracene	120-12-7	410		N
Benz[a]anthracene	56-55-3	0.0043		C
Benzo[a]pyrene	50-32-8	0.00043		C
Benzo[b]fluoranthene	205-99-2	0.0043		C
Benzo[g,h,i]perylene	191-24-2	41	(c)	N
Benzo[k]fluoranthene	207-08-9	0.043		C
bis(2-Chloroethoxy)methane	111-91-1	NA		D
bis(2-Chloroethyl)ether	111-44-4	0.0029		C
bis(2-Ethylhexyl)phthalate	117-81-7	0.23		C
Butyl benzyl phthalate	85-68-7	270		N
Carbazole	86-74-8	0.16		C
Chrysene	218-01-9	0.43		C
Dibenz[a,h]anthracene	53-70-3	0.00043		C
Dibenzofuran	132-64-9	5.4		N
Diethylphthalate	84-66-2	1100		N

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg)	(n)	Basis
Dimethyl phthalate	131-11-3	14000		N
Di-n-butyl phthalate	84-74-2	140		N
Di-n-octyl phthalate	117-84-0	27		N
Fluoranthene	206-44-0	54		N
Fluorene	86-73-7	54		N
Hexachlorobenzene	118-74-1	0.002		C
Hexachlorobutadiene	87-68-3	0.04		C
Hexachlorocyclopentadiene	77-47-4	9.5		N
Hexachloroethane	67-72-1	0.23		C
Indeno[1,2,3-cd]pyrene	193-39-5	0.0043		C
Isophorone	78-59-1	3.3		C
Naphthalene	91-20-3	27		N
Nitrobenzene	98-95-3	0.68		N
N-Nitroso-di-n-propylamine	621-64-7	0.00045		C
N-Nitrosodiphenylamine	86-30-6	0.64		C
Pentachlorophenol	87-86-5	0.026		C
Phenanthrene	85-01-8	410	(d)	N
Phenol	108-95-2	810		N
Pyrene	129-00-0	41		N
TAL Metals				
Aluminum	7429-90-5	1400		N
Antimony	7440-36-0	0.54		N
Arsenic	7440-38-2	0.0021		C
Barium	7440-39-3	95		N
Beryllium	7440-41-7	2.7		N
Cadmium	7440-43-9	1.4	(f)	N
Calcium	7440-70-2	NA		B
Chromium	7440-47-3	4.1	(g)	N
Cobalt	7440-48-4	81		N
Iron	7439-89-6	410		N
Lead	7439-92-1	NA		O
Magnesium	7439-95-4	NA		B
Manganese	7439-96-5	190	(h)	N
Nickel	7440-02-0	27		N
Potassium	7440-09-7	NA		B
Selenium	7782-49-2	6.8		N
Silver	7440-22-4	6.8		N
Sodium	7440-23-5	NA		B
Thallium	7440-28-0	0.095		N
Vanadium	7440-62-2	9.5		N
Mercury	7439-97-6	0.14	(e)	N
Copper	7440-50-8	54		N
Zinc	7440-66-6	410		N
Cyanide	57-12-5	27		N

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (n)		Basis
PCBs				
Total PCBs	NA	0.0016		C
Pesticides				
Alpha-BHC	319-84-6	0.0005		C
Beta-BHC	319-85-7	0.0018		C
Delta-BHC	319-86-8	0.0018	(i)	C
Gamma-BHC (Lindane)	58-89-9	0.0024		C
Aldrin	309-00-2	0.00019		C
alpha-Chlordane	5103-71-9	0.009	(j)	C
gamma-Chlordane	5103-74-2	0.009	(j)	C
Chlordane	57-74-9	0.009		C
Chlorobenzilate	510-15-6	0.012		C
1,2-Dibromo-3-Chloropropane (DBCP)	96-12-8	0.0023		C
4,4'-DDD	72-54-8	0.013		C
4,4'-DDE	72-55-9	0.0093		C
4,4'-DDT	50-29-3	0.0093		C
Diallate	2303-16-4	NA		O
Dieldrin	60-57-1	0.0002		C
Endosulfan I	959-98-8	8.1	(k)	N
Endosulfan II	33213-65-9	8.1	(k)	N
Endosulfan sulfate	1031-07-8	8.1	(k)	N
Endrin	72-20-8	0.41		N
Endrin aldehyde	7421-93-4	0.41	(l)	N
Endrin Ketone	53494-70-5	0.41	(l)	N
Heptachlor	76-44-8	0.0007		C
Heptachlor epoxide	1024-57-3	0.00035		C
Hexachlorobenzene	118-74-1	0.002		C
Hexachlorocyclopentadiene	77-47-4	9.5		N
Isodrin	465-73-6	NA		D
Methoxychlor	72-43-5	6.8		N
Toxaphene	8001-35-2	0.0029		C
Herbicides				
2,4-D	94-75-7	14		N
2,4-DB	94-82-6	NA		O
2,4,5-TP	93-72-1	NA		O
2,4,5-T	93-76-5	14		N
Dalapon	75-99-0	41		N
Dicamba	1918-00-9	41		N
Dichloroprop	120-36-5	NA		O
Dinoseb	88-85-7	1.4		N
MCPA	94-74-6	NA		O
MCPP	93-65-2	NA		O
4-Nitrophenol	100-02-7	11		N
Pentachlorophenol	87-86-5	0.026		C

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (n)	Basis
Dioxins and Furans			
2,3,7,8-TCDD	1746-01-6	2.10E-08	C
1,2,3,7,8-PentaCDD	40321-76-4	2.10E-08	C
1,2,3,4,7,8-HexaCDD	39227-28-6	2.10E-08	C
1,2,3,6,7,8-HexaCDD	57653-85-7	2.10E-08	C
1,2,3,7,8,9-HexaCDD	19408-74-3	2.10E-08	C
1,2,3,4,6,7,8-HeptaCDD	35822-39-4	2.10E-08	C
OctaCDD	3268-87-9	2.10E-08	C
2,3,7,8-TetraCDF	51207-31-9	2.10E-08	C
1,2,3,7,8-PentaCDF	57117-41-6	2.10E-08	C
2,3,4,7,8-PentaCDF	57117-31-4	2.10E-08	C
1,2,3,4,7,8-HexaCDF	70648-26-9	2.10E-08	C
1,2,3,6,7,8-HexaCDF	57117-44-9	2.10E-08	C
1,2,3,7,8,9-HexaCDF	72918-21-9	2.10E-08	C

TABLE 3
DATA QUALITY LIMITS (DQLs) FOR FISH TISSUE
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (mg/kg) (n)	Basis
2,3,4,6,7,8-HexaCDF	60851-34-5	2.10E-08	C
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	2.10E-08	C
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	2.10E-08	C
OctaCDF	39001-02-0	2.10E-08	C

Notes:
B = No value is available as this constituent is an essential nutrient.
C = USEPA, 1998e, Based on carcinogenic USEPA Region 3 RBC value.
D = No toxicological value available, therefore, no DQL was developed.
N = USEPA, 1998e, Based on non-carcinogenic USEPA Region 3 RBC value.
O = No RBC available; therefore, no DQL developed.
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not Available.
PCB = Polychlorinated Biphenyl.
PRG = USEPA Region 9 Preliminary Remediation Goal (USEPA, 1998c).
RBC = USEPA Region 3 Risk Based Concentration (USEPA, 1998e).
TAL = Target Analyte List.
TCL = Target Compound List.
(a) Due to structural similarities, the value for 4-Nitrophenol was used.
(b) Due to structural similarities, the value for Acenaphthene was used.
(c) Due to structural similarities, the value for Pyrene was used.
(d) Due to structural similarities, the value for Anthracene was used.
(e) Value for Methyl Mercury.
(f) Value for Cadmium-food.
(g) Value for Chromium IV.
(h) Value for Manganese-food.
(i) Due to structural similarities, the value for Beta BHC was used.
(j) Due to structural similarities, the value for Chlordane was used.
(k) Due to structural similarities, the value for Endosulfan was used.
(l) Due to structural similarities, the value for Endrin was used.
(m) Due to structural similarities, the value for Bis(2-Chloroisopropyl) ether was used.
(n) DQLs for Fish Tissue based on USEPA Region 3 RBCs (USEPA, 1998e).

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (ug/m^3) (a)	Basis
TCL Volatiles			
1,1,1-Trichloroethane	71-55-6	1000	A
1,1,2,2-Tetrachloroethane	79-34-5	0.033	B
1,1,2-Trichloroethane	79-00-5	0.12	B
1,1-Dichloroethane	75-34-3	520	A
1,1-Dichloroethylene	75-35-4	0.038	B
1,2-Dichloroethane	107-06-2	0.074	B
1,2-Dichloroethylene (total)	540-59-0	37 (c)	A
1,2-Dichloropropane	78-87-5	0.099	B
2-Butanone	78-93-3	1000	A
2-Hexanone	591-78-6	83 (d)	A
4-Methyl-2-pentanone	108-10-1	83	A
Acetone	67-64-1	370	A
Benzene	71-43-2	0.23	B
Bromodichloromethane	75-27-4	0.11	B
Bromoform	75-25-2	1.7	B
Bromomethane	74-83-9	5.2	A
Carbon Disulfide	75-15-0	730	A
Carbon tetrachloride	56-23-5	0.13	B
Chlorobenzene	108-90-7	21	A
Chloroethane	75-00-3	NA	D
Chloroform	67-66-3	0.084	B
Chloromethane	74-87-3	1.1	B
cis-1,3-Dichloropropene	10061-01-5	0.052 (e)	B
Dibromochloromethane	124-48-1	0.08	B
Ethyl Benzene	100-41-4	1100	A
Methylene chloride	75-09-2	4.1	B
Styrene	100-42-5	1100	A
Tetrachloroethene	127-18-4	3.3	B
Toluene	108-88-3	400	A
Total Xylenes	1330-20-7	730	A
trans-1,3-Dichloropropene	10061-02-6	0.052 (e)	B
Trichloroethene	79-01-6	1.1	B
Vinyl chloride	75-01-4	0.022	B
TCL Semi-Volatiles			
1,2,4-Trichlorobenzene	120-82-1	210	A
1,2-Dichlorobenzene	95-50-1	210	A
1,3-Dichlorobenzene	541-73-1	8.4	A
1,4-Dichlorobenzene	106-46-7	0.28	B
2,2'-oxybis(1-Chloropropane)	108-60-1	0.19 (b)	B
2,4,5-Trichlorophenol	95-95-4	370	A
2,4,6-Trichlorophenol	88-06-2	0.62	B
2,4-Dichlorophenol	120-83-2	11	A
2,4-Dimethylphenol	105-67-9	73	A
2,4-Dinitrophenol	51-28-5	7.3	A
2,4-Dinitrotoluene	121-14-2	7.3	A
2,6-Dinitrotoluene	606-20-2	3.7	A
2-Chloronaphthalene	91-58-7	290	A
2-Chlorophenol	95-57-8	18	A

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (ug/m^3) (a)		Basis
2-Methylnaphthalene	91-57-6	3.1	(f)	A
2-Methylphenol	95-48-7	180		A
2-Nitroaniline	88-74-4	0.21		A
2-Nitrophenol	88-75-5	230	(g)	A
3,3'-Dichlorobenzidine	91-94-1	0.015		B
3-Nitroaniline	99-09-2	0.21	(h)	A
4,6-Dinitro-2-methylphenol	534-52-1	NA		C
4-Bromophenyl phenyl ether	101-55-3	NA		C
4-Chloraniline	106-47-8	15		A
4-Chloro-3-methylphenol	59-50-7	NA		C
4-Chlorophenol phenyl ether	7005-72-3	NA		C
4-Methylphenol	106-44-5	18		A
4-Nitroaniline	100-01-6	0.21	(h)	A
4-Nitrophenol	100-02-7	230		A
Acenaphthene	83-32-9	220		A
Acenaphthylene	208-96-8	220	(i)	A
Anthracene	120-12-7	1100		A
Benz[a]anthracene	56-55-3	0.022		B
Benzo[a]pyrene	50-32-8	0.0022		B
Benzo[b]fluoranthene	205-99-2	0.022		B
Benzo[g,h,i]perylene	191-24-2	110	(j)	A
Benzo[k]fluoranthene	207-08-9	0.22		B
bis(2-Chloroethoxy)methane	111-91-1	NA		C
bis(2-Chloroethyl)ether	111-44-4	0.0058		B
bis(2-Ethylhexyl)phthalate	117-81-7	0.48		B
Butyl benzyl phthalate	85-68-7	730		A
Carbazole	86-74-8	0.34		B
Chrysene	218-01-9	2.2		B
Dibenz[a,h]anthracene	53-70-3	0.0022		B
Dibenzofuran	132-64-9	15		A
Diethylphthalate	84-66-2	2900		A
Dimethyl phthalate	131-11-3	37000		B
Di-n-butyl phthalate	84-74-2	370		A
Di-n-octyl phthalate	117-84-0	73		A
Fluoranthene	206-44-0	150		A
Fluorene	86-73-7	150		A
Hexachlorobenzene	118-74-1	0.0042		B
Hexachlorobutadiene	87-68-3	0.087		B
Hexachlorocyclopentadiene	77-47-4	0.073		A
Hexachloroethane	67-72-1	0.48		B
Indeno[1,2,3-cd]pyrene	193-39-5	0.022		B
Isophorone	78-59-1	7.1		B
Naphthalene	91-20-3	3.1		A
Nitrobenzene	98-95-3	2.1		A
N-Nitroso-di-n-propylamine	621-64-7	0.00096		B
N-Nitrosodiphenylamine	86-30-6	1.4		B
Pentachlorophenol	87-86-5	0.056		B
Phenanthrene	85-01-8	1100	(k)	A
Phenol	108-95-2	2200		A
Pyrene	129-00-0	110		A

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (ug/m^3) (a)	Basis
TAL Metals			
Aluminum	7429-90-5	NA	
Antimony	7440-36-0	NA	
Arsenic	7440-38-2	0.00045	B
Barium	7440-39-3	0.52	A
Beryllium	7440-41-7	0.0008	B
Cadmium	7440-43-9	0.0011	B
Calcium	7440-70-2	NA	
Chromium	7440-47-3	0.000023 (l)	B
Cobalt	7440-48-4	0.021	A
Iron	7439-89-6	NA	
Lead	7439-92-1	NA	
Magnesium	7439-95-4	NA	
Manganese	7439-96-5	0.051	A
Nickel	7440-02-0	0.008 (m)	B
Potassium	7440-09-7	NA	
Selenium	7782-49-2	NA	
Silver	7440-22-4	NA	
Sodium	7440-23-5	NA	
Thallium	7440-28-0	NA	
Vanadium	7440-62-2	NA	
Mercury	7439-97-6	0.31	A
Copper	7440-50-8	NA	
Zinc	7440-66-6	NA	
Cyanide	57-12-5	NA	
PCBs			
Total PCBs	NA	0.0034	B

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (ug/m^3) (a)	Basis
Dioxins and Furans			
2,3,7,8-TCDD	1746-01-6	4.50E-08	B
1,2,3,7,8-PentaCDD	40321-76-4	4.50E-08	B
1,2,3,4,7,8-HexaCDD	39227-28-6	4.50E-08	B
1,2,3,6,7,8-HexaCDD	57653-85-7	4.50E-08	B
1,2,3,7,8,9-HexaCDD	19408-74-3	4.50E-08	B
1,2,3,4,6,7,8-HeptaCDD	35822-39-4	4.50E-08	B
OctaCDD	3268-87-9	4.50E-08	B
2,3,7,8-TetraCDF	51207-31-9	4.50E-08	B
1,2,3,7,8-PentaCDF	57117-41-6	4.50E-08	B
2,3,4,7,8-PentaCDF	57117-31-4	4.50E-08	B
1,2,3,4,7,8-HexaCDF	70648-26-9	4.50E-08	B
1,2,3,6,7,8-HexaCDF	57117-44-9	4.50E-08	B
1,2,3,7,8,9-HexaCDF	72918-21-9	4.50E-08	B
2,3,4,6,7,8-HexaCDF	60851-34-5	4.50E-08	B
1,2,3,4,6,7,8-HeptaCDF	67562-39-4	4.50E-08	B
1,2,3,4,7,8,9-HeptaCDF	55673-89-7	4.50E-08	B
OctaCDF	39001-02-0	4.50E-08	B
Additional (added 4/17/99)			
Benzyl Alcohol	100-51-6	1.1E+03	A
Bis(2-chloroisopropyl)ether (2,2'-oxybi	108-60-1	1.9E-01 (b)	B
Dichlorodifluoromethane	75-71-8	2.1E+02	A
Trichlorofluoromethane	75-69-4	7.3E+02	A
1,1-Dichloroethene	75-35-4	3.8E-02	B
Trans-1,2-dichloroethene	156-60-5	7.3E+01	A
2,2-Dichloropropane	594-20-7	NA	C
Cis-1,2-dichloroethene	156-59-2	3.7E+01	A
Bromochloromethane	74-97-5	NA	C
1,1-Dichloropropylene	563-58-6	NA	C
Dibromomethane	74-95-3	3.7E+01	A
1,3-Dichloropropane	142-28-9	NA	C
1,2-Dibromomethane	106-93-4	8.7E-03	B
1,1,1,2-Tetrachloroethane	630-20-6	2.6E-01	B
M & p xylenes	108-38-3	7.3E+02	A
o-xylene	95-47-6	7.3E+02	A
isopropylbenzene	104-5-18	3.7E+01	A
1,2,3,-trichloropropane	96-18-4	9.6E-04	B
n-proplybenzene	104-51-8	3.7E+01	A
Bromobenzene	108-86-1	1.0E+01	A
1,3,5-Trimethylbenzene	108-67-8	6.2E+00	A
2-Chlorotoluene	95-49-8	7.3E+01	A
4-Chlorotoluene	106-43-4	7.3E+01 (n)	A
t-Butylbenzene	104-5-18	3.7E+01	A
1,2,4-Trimethylbenzene	95-63-6	6.2E+00	A
s-Butylbenzene	135-9-88	3.7E+01	A
p-Isopropyltoluene	99-87-6	NA	C
n-Butylbenzene	104-51-8	3.7E+01	A
1,2-Dibromo-3-chloropropane	96-12-8	2.1E-01	A

TABLE 4
DATA QUALITY LIMITS (DQLs) FOR AIR
SAUGET AREA 1 EE/CA AND RI/FS
SAUGET AND CAHOKIA, ILLINOIS
SOLUTIA, INC.

CONSTITUENT	CAS NO.	DQL (ug/m^3) (a)	Basis
1,2,3-Trichlorobenzene	87-61-6	NA	C
Vinyl acetate	108-05-4	2.1E+02	A

Notes:
CAS = Chemical Abstracts Service.
CB = Chlorobiphenyl.
CDD = Chlorodibenzodioxin.
CDF = Chlorodibenzofuran.
DQL = Data Quality Limit.
NA = Not available.
PCB = Polychlorinated Biphenyl.
PRG = Preliminary Remedial Goal.
TAL = Target Analyte List.
TCL = Target Compound List.
(a) Air DQLs are based on USEPA Region IX PRG Table. (USEPA, 1998c)
(b) Synonym of Bis(2-Chloroisopropyl ether)
(c) Value for cis-1,2-Dichloroethylene used.
(d) Due to structural similarities, the value for 4-Methyl-2-Pentanone was used.
(e) Value for 1,3-Dichloropropene.
(f) Due to structural similarities, the value for Naphthalene was used.
(g) Due to structural similarities, the value for 4-Nitrophenol was used.
(h) Due to structural similarities, the value for 2-Nitroaniline was used.
(i) Due to structural similarities, the value for Acenaphthene was used.
(j) Due to structural similarities, the value for Pyrene was used.
(k) Due to structural similarities, the value for Anthracene was used.
(l) Value for Chromium IV.
(m) Value for Nickel Refinery Dust.
(n) - Due to structural similarities, the value for 2-Chlorotoluene was used.
A = Region IX PRG, based on non-carcinogenic effects.
B = Region IX PRG, based on carcinogenic effects.
C = No Toxicological value available.

APPENDIX B

TACO TIER I CRITERIA

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.TABLE A: Tier 1 Soil Remediation Objectives[a] for Residential Properties

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
83-32-9	Acenaphthene	4,700[b]	---[c]	570[b]	2,900	*
67-64-1	Acetone	7,800[b]	100,000[d]	16[b]	16	*
15972-60-8	Alachlor[o]	8[e]	---[c]	0.04	0.2	NA
116-06-3	Aldicarb[o]	78[b]	---[c]	0.013	0.07	NA
309-00-2	Aldrin	0.04[e]	3[e]	0.5[e]	2.5	*
120-12-7	Anthracene	23,000[b]	---[c]	12,000[b]	59,000	*
1912-24-9	Atrazine[o]	2700[b]	---[c]	0.066	0.33	NA
71-43-2	Benzene	22[e]	0.8[e]	0.03	0.17	*
56-55-3	Benzo(*a*)anthracene	0.9[e]	---[c]	2	8	*
205-99-2	Benzo(*b*)fluoranthene	0.9[e]	---[c]	5	25	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
207-08-9	Benzo(*k*)fluroanthene	9[e]	---[c]	49	250	*
50-32-8	Benzo(*a*)pyrene	0.09[e,f]	---[c]	8	82	*
111-44-4	Bis(2-chloroethyl)ether	0.6[e]	0.2[e,f]	0.0004[e,f]	0.0004	0.66
117-81-7	Bis(2-ethylhexyl)phthalate	46[e]	31,000[d]	3,600	31,000[d]	*
75-27-4	Bromodichloromethane (Dichlorobromomethane)	10[e]	3,000[d]	0.6	0.6	*
75-25-2	Bromoform	81[e]	53[e]	0.8	0.8	*
71-36-3	Butanol	7,800[b]	10,000[d]	17[b]	17	NA
85-68-7	Butyl benzyl phthalate	16,000[b]	930[d]	930[d]	930[d]	*
86-74-8	Carbazole	32[e]	---[c]	0.6[e]	2.8	NA
1563-66-2	Carbofuran[o]	390[b]	---[c]	0.22	1.1	NA
75-15-0	Carbon disulfide	7,800[b]	720[d]	32[b]	160	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
56-23-5	Carbon tetrachloride	5[e]	0.3[e]	0.07	0.33	*
57-74-9	Chlordane	0.5[e]	20[e]	10	48	*
106-47-8	4-Chloroaniline (*p*-Chloroaniline)	310[b]	---[c]	0.7[b]	0.7	1.3
108-90-7	Chlorobenzene (Monochlorobenzene)	1,600[b]	130[b]	1	6.5	*
124-48-1	Chlorodibromomethane (Dibromochloromethane)	1,600[b]	1,300[d]	0.4	0.4	*
67-66-3	Chloroform	100[e]	0.3[e]	0.6	2.9	*
218-01-9	Chrysene	88[e]	---[c]	160	800	*
94-75-7	2,4-D	780[b]	---[c]	1.5	7.7	*
75-99-0	Dalapon	2,300[b]	---[c]	0.85	8.5	1.2
72-54-8	DDD	3[e]	---[c]	16[e]	80	*
72-55-9	DDE	2[e]	---[c]	54[e]	270	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
50-29-3	DDT	2[e]	---[g]	32[e]	160	*
53-70-3	Dibenzo(*a,h*)anthracene	0.09[e,f]	---[c]	2	7.6	*
96-12-8	1,2-Dibromo-3-chloropropane	0.46[e]	11[b]	0.002	0.002	*
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.0075[e]	0.17[e]	0.0004	0.004	0.005
84-74-2	Di-*n*-butyl phthalate	7,800[b]	2,300[d]	2,300[d]	2,300[d]	*
95-50-1	1,2-Dichlorobenzene (*o* - Dichlorobenzene)	7,000[b]	560[d]	17	43	*
106-46-7	1,4-Dichlorobenzene (*p* - Dichlorobenzene)	---[c]	---[g]	2	11	*
91-94-1	3,3'-Dichlorobenzidine	1[e]	---[c]	0.007[e,f]	0.033	1.3
75-34-3	1,1-Dichloroethane	7,800[b]	1,300[b]	23[b]	110	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	7[e]	0.4[e]	0.02	0.1	*
75-35-4	1,1-Dichloroethylene	700[b]	1,500[d]	0.06	0.3	*
156-59-2	*cis*-1,2-Dichloroethylene	780[b]	1,200[d]	0.4	1.1	*
156-60-5	*trans*-1,2-Dichloroethylene	1,600[b]	3,100[d]	0.7	3.4	*
78-87-5	1,2-Dichloropropane	9[e]	15[b]	0.03	0.15	*
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*)	4[e]	0.1[e]	0.004[e]	0.02	0.005
60-57-1	Dieldrin[n]	0.04[e]	1[e]	0.004[e]	0.02	*
84-66-2	Diethyl phthalate	63,000[b]	2,000[d]	470[b]	470	*
105-67-9	2,4-Dimethylphenol	1,600[b]	---[c]	9[b]	9	*
121-14-2	2,4-Dinitrotoluene	0.9[e]	---[c]	0.0008[e,f]	0.0008	0.013

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
606-20-2	2,6-Dinitrotoluene	0.9[e]	---[c]	0.0007[e,f]	0.0007	0.0067
117-84-0	Di-*n*-octyl phthalate	1,600[b]	10,000[d]	10,000[d]	10,000[d]	*
115-29-7	Endosulfan	470[b]	---[c]	18[b]	90	*
145-73-3	Endothall[o]	1,600[b]	---[c]	0.4	0.4	NA
72-20-8	Endrin	23[b]	---[c]	1	5	*
100-41-4	Ethylbenzene	7,800[b]	400[d]	13	19	*
206-44-0	Fluoranthene	3,100[b]	---[c]	4,300[b]	21,000	*
86-73-7	Fluorene	3,100[b]	---[c]	560[b]	2,800	*
76-44-8	Heptachlor	0.1[e]	0.1[e]	23	110	*
1024-57-3	Heptachlor epoxide	0.07[e]	5[e]	0.7	3.3	*
118-74-1	Hexachlorobenzene	0.4[e]	1[e]	2	11	*
319-84-6	*alpha*-HCH (*alpha*-BHC)	0.1[e]	0.8[e]	0.0005[e,f]	0.003	0.002

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
58-89-9	*gamma*-HCH (Lindane)[n]	0.5[e]	---[c]	0.009	0.047	*
77-47-4	Hexachlorocyclopentadien e	550[b]	10[b]	400	2,200[d]	*
67-72-1	Hexachloroethane	78[b]	---[c]	0.5[b]	2.6	*
193-39-5	Indeno(1,2,3-*c,d*)pyrene	0.9[e]	---[c]	14	69	*
78-59-1	Isophorone	15,600[b]	4,600[d]	8[b]	8	*
72-43-5	Methoxychlor	390[b]	---[c]	160	780	*
74-83-9	Methyl bromide (Bromomethane)	110[b]	10[b]	0.2[b]	1.2	*
75-09-2	Methylene chloride (Dichloromethane)	85[e]	13[e]	0.02[e]	0.2	*
95-48-7	2-Methylphenol (*o* - Cresol)	3,900[b]	---[c]	15[b]	15	*
91-20-3	Naphthalene	3,100[b]	---[c]	84[b]	420	*
98-95-3	Nitrobenzene	39[b]	92[b]	0.1[b,f]	0.1	0.26

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
86-30-6	*N*-Nitrosodiphenylamine	130[f]	---[c]	1[e]	5.6	*
621-64-7	*N*-Nitrosodi-*n*-propylamine	0.09[e,f]	---[c]	0.00005[e,f]	0.00005	0.66
108-95-2	Phenol	47,000[b]	---[c]	100[b]	100	*
1918-02-1	Picloram[o]	5,500[b]	---[c]	2	20	NA
1336-36-3	Polychlorinated biphenyls (PCBs)[n]	1; 10[h]	---[c,h]	---[h]	---[h]	*
129-00-0	Pyrene	2,300[b]	---[c]	4,200[b]	21,000	*
122-34-9	Simazine[o]	390[b]	---[c]	0.04	0.37	NA
100-42-5	Styrene	16,000[b]	1,500[d]	4	18	*
127-18-4	Tetrachloroethylene (Perchloroethylene)	12[e]	11[e]	0.06	0.3	*
108-88-3	Toluene	16,000[b]	650[d]	12	29	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
8001-35-2	Toxaphene[n]	0.6[e]	89[e]	31	150	*
120-82-1	1,2,4-Trichlorobenzene	780[b]	3,200[b]	5	53	*
71-55-6	1,1,1-Trichloroethane	---[c]	1,200[d]	2	9.6	*
79-00-5	1,1,2-Trichloroethane	310[b]	1,800[d]	0.02	0.3	*
79-01-6	Trichloroethylene	58[e]	5[e]	0.06	0.3	*
108-05-4	Vinyl acetate	78,000[b]	1,000[b]	170[b]	170	*
75-01-4	Vinyl chloride	0.3[e]	0.03[e]	0.01[f]	0.07	*
108-38-3	m-Xylene	160,000[b]	420[d]	210	210	*
95-47-6	o-Xylene	160,000[b]	410[d]	190	190	*
106-42-3	p-Xylene	160,000[b]	460[d]	200	200	*

		Exposure Route-Specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
1330-20-7	Xylenes (total)	160,000[b]	410[d]	150	150	*
	Ionizable Organics					
65-85-0	Benzoic Acid	310,000[b]	---[c]	400[b,i]	400[i]	*
95-57-8	2-Chlorophenol	390[b]	53,000[d]	4[b,i]	4[i]	*
120-83-2	2,4-Dichlorophenol	230[b]	---[c]	1[b,i]	1[i]	*
51-28-5	2,4-Dinitrophenol	160[b]	---[c]	0.2[b,f]	0.2	3.3
88-85-7	Dinoseb[o]	78[b]	---[c]	0.34[b,i]	3.4[i]	*
87-86-5	Pentachlorophenol	3[e,j]	---[c]	0.03[f,i]	0.14[i]	2.4
93-72-1	2,4,5-TP (Silvex)	630[b]	---[c]	11[i]	55[i]	*
95-95-4	2,4,5-Trichlorophenol	7,800[b]	---[c]	270[b,i]	1,400[i]	*
88-06-2	2,4,6 Trichlorophenol	58[e]	200[e]	0.2[e,f,i]	0.77[i]	0.43

		Exposure Route-specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L)	Class II (mg/L)	ADL (mg/kg)
	Inorganics					
7440-36-0	Antimony	31[b]	---[c]	0.006[m]	0.024[m]	*
7440-38-2	Arsenic[l,n]	0.4[e,t]	750[e]	0.05[m]	0.2[m]	*
7440-39-3	Barium	5,500[b]	690,000[b]	2.0[m]	2.0[m]	*
7440-41-7	Beryllium	0.1[e,t]	1,300[e]	0.004[m]	0.5[m]	*
7440-42-8	Boron	7,000[b]	---[g]	2.0[m]	2.0[m]	*
7440-43-9	Cadmium[l,n]	78[b, r]	1,800[e]	0.005[m]	0.05[m]	*
16887-00-6	Chloride	---[c]	---[c]	200[m]	200[m]	*
7440-47-3	Chromium, total	390[b]	270[e]	0.1[m]	1.0[m]	*
16065-83-1	Chromium, ion, trivalent	78,000[b]	---[c]	---[g]	---[g]	*
18540-29-9	Chromium, ion, hexavalent	390[b]	270[e]	---	---	*
7440-48-4	Cobalt	4,700[b]	---[c]	1.0[m]	1.0[m]	*

		Exposure Route-specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L)	Class II (mg/L)	ADL (mg/kg)
7440-50-8	Copper[n]	2,900[b]	---[c]	0.65[m]	0.65[m]	*
57-12-5	Cyanide (amenable)	1,600[b]	---[c]	0.2[q]	0.6[q]	*
7782-41-4	Fluoride	4,700[b]	---[c]	4.0[m]	4.0[m]	*
15438-31-0	Iron	---[c]	---[c]	5.0[m]	5.0[m]	*
7439-92-1	Lead	400[k]	---[c]	0.0075[m]	0.1[m]	*
7439-96-5	Manganese	3,700[b]	69,000[b]	0.15[m]	10.0[m]	*
7439-97-6	Mercury[l,n]	23[b,s]	10[b,i]	0.002[m]	0.01[m]	*
7440-02-0	Nickel[l]	1,600[b]	13,000[e]	0.1[m]	2.0[m]	*
14797-55-8	Nitrate as N[p]	130,000[b]	---[c]	10.0[q]	100[q]	*
7782-49-2	Selenium[l,n]	390[b]	---[c]	0.05[m]	0.05[m]	*

		Exposure Route-specific Values for Soils		Soil Component of the Groundwater Ingestion Exposure Route Values		
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L)	Class II (mg/L)	ADL (mg/kg)
7440-22-4	Silver	390[b]	---[c]	0.05[m]	---	*
14808-79-8	Sulfate	---[c]	---[c]	400[m]	400[m]	*
7440-28-0	Thallium	6.3[b,u]	---[c]	0.002[m]	0.02[m]	*
7440-62-2	Vanadium	550[b]	---[c]	0.049[m]	---	*
7440-66-6	Zinc[l]	23,000[b]	---[c]	5.0[m]	10[m]	*

"*" indicates that the ADL is less than or equal to the specified remediation objective.
NA means not available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Remediation Objective Notations

[a] Soil remediation objectives based on human health criteria only.
[b] Calculated values correspond to a target hazard quotient of 1.
[c] No toxicity criteria available for the route of exposure.
[d] Soil saturation concentration ($C_{[sat]}$) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
[e] Calculated values correspond to a cancer risk level of 1 in 1,000,000.
[f] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
[g] Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
[h] A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 - USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the remediation goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
[i] Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D of this Part.
[j] Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
[k] A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
[l] Potential for soil-plant-human exposure.
[m] The person conducting the remediation has the option to use: 1) TCLP or SPLP test results to compare with the remediation objectives listed in this Table; or 2) the total amount of contaminant in the soil sample results to compare with pH specific remediation objectives listed in Appendix B, Table C or D of this Part. (See Section 742.510.) If the person conducting the remediation wishes to calculate soil remediation objectives based on background concentrations, this should be done in accordance with Subpart D of this Part.
[n] The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
[o] For agrichemical facilities, remediation objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
[p] For agrichemical facilities, soil remediation objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the procedures set forth in Subparts D and I of this Part.
[q] The TCLP extraction must be done using water at a pH of 7.0.
[r] Value based on dietary Reference Dose.
[s] Value based on Reference Dose for Mercuric chloride (CAS No. 7487-94-7).
[t] Note that Table value is likely to be less than background concentration for this chemical; screening or remediation concentrations using the procedures of Subpart D of this Part may be more appropriate.

[u] Value based on Reference Dose for thallium sulfate (CAS No. 7446-18-6).

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.Table B: Tier 1 Soil Remediation Objectives[a] for Industrial/Commercial Properties

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	ClassII (mg/kg)	ADL (mg/kg)
83-32-9	Acenaphthene	120,000[b]	-----[c]	120,000[b]	-----[c]	570[b]	2,900	*
67-64-1	Acetone	200,000[b]	100,000[d]	200,000[b]	100,000[d]	16[b]	16	*
15972-60-8	Alachlor[o]	72[e]	-----[c]	1,600[e]	-----[c]	0.04	0.2	NA
116-06-3	Aldicarb[o]	2,000[b]	-----[c]	200[b]	-----[c]	0.013	0.07	NA
309-00-2	Aldrin	0.3[e]	6.6[e]	6.1[b]	9.3[e]	0.5[e]	2.5	*
120-12-7	Anthracene	610,000[b]	-----[c]	610,000[b]	-----[c]	12,000[b]	59,000	*
1912-24-9	Atrazine[o]	72,000[b]	-----[c]	7,100[b]	-----[c]	0.066	0.33	NA
71-43-2	Benzene	200[e]	1.5[e]	4,300[e]	2.1[e]	0.03	0.17	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
56-55-3	Benzo(*a*)anthracene	8[e]	-----[c]	170[e]	-----[c]	2	8	*
205-99-2	Benzo(*b*)fluoranthene	8[e]	-----[c]	170[e]	-----[c]	5	25	*
207-08-9	Benzo(*k*)fluroanthene	78[e]	-----[c]	1,700[e]	-----[c]	49	250	*
50-32-8	Benzo(*a*)pyrene	0.8[e]	-----[c]	17[e]	-----[c]	8	82	*
111-44-4	Bis(2-chloroethyl)ether	5[e]	0.47[e]	75[e]	0.66[e]	0.0004[e,f]	0.0004	0.66
117-81-7	Bis(2-ethylhexyl)phthalate	410[e]	31,000[d]	4,100[b]	31,000[d]	3,600	31,000[d]	*
75-27-4	Bromodichloromethane (Dichlorobromomethane)	92[e]	3,000[d]	2,000[e]	3,000[d]	0.6	0.6	*
75-25-2	Bromoform	720[e]	100[e]	16,000[e]	140[e]	0.8	0.8	*
71-36-3	Butanol	200,000[b]	10,000[d]	200,000[b]	10,000[d]	17[b]	17	NA
85-68-7	Butyl benzyl phthalate	410,000[b]	930[d]	410,000[b]	930[d]	930[d]	930[d]	*
86-74-8	Carbazole	290[e]	-----[c]	6,200[e]	-----[c]	0.6[e]	2.8	NA

(((

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
1563-66-2	Carbofuran[o]	10,000[b]	-----[c]	1,000[b]	-----[c]	0.22	1.1	NA
75-15-0	Carbon disulfide	200,000[b]	720[d]	20,000[b]	9.0[b]	32[b]	160	*
56-23-5	Carbon tetrachloride	44[e]	0.64[e]	410[b]	0.90[e]	0.07	0.33	*
57-74-9	Chlordane	4[e]	38[e]	12[b]	53[e]	10	48	*
106-47-8	4 - Chloroaniline (*p*-Chloroaniline)	8,200[b]	-----[c]	820[b]	-----[c]	0.7[b]	0.7	1.3
108-90-7	Chlorobenzene (Monochlorobenzene)	41,000[b]	210[b]	4,100[b]	1.3[b]	1	6.5	*
124-48-1	Chlorodibromomethane (Dibromochloromethane)	41,000[b]	1,300[d]	41,000[b]	1,300[d]	0.4	0.4	*
67-66-3	Chloroform	940[e]	0.54[e]	2,000[b]	0.76[e]	0.6	2.9	*
218-01-9	Chrysene	780[e]	-----[c]	17,000[e]	-----[c]	160	800	*
94-75-7	2,4-D	20,000[b]	-----[c]	2,000[b]	-----[c]	1.5	7.7	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
75-99-0	Dalapon	61,000[b]	-----[c]	6,100[b]	-----[c]	0.85	8.5	1.2
72-54-8	DDD	24[e]	-----[c]	520[e]	-----[c]	16[e]	80	*
72-55-9	DDE	17[e]	-----[c]	370[e]	-----[c]	54[e]	270	*
50-29-3	DDT	17[e]	1,500[e]	100[b]	2,100[e]	32[e]	160	*
53-70-3	Dibenzo(*a,h*)anthracene	0.8[e]	-----[c]	17[e]	-----[c]	2	7.6	*
96-12-8	1,2-Dibromo-3-chloropropane	4[e]	17[b]	89[e]	0.11[b]	0.002	0.002	*
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.07[e]	0.32[e]	1.5[e]	0.45[e]	0.0004	0.004	0.005
84-74-2	Di-*n*-butyl phthalate	200,000[b]	2,300[d]	200,000[b]	2,300[d]	2,300[d]	2,300[d]	*
95-50-1	1,2-Dichlorobenzene (*o* - Dichlorobenzene)	180,000[b]	560[d]	18,000[b]	310[b]	17	43	*
106-46-7	1,4-Dichlorobenzene (*p* - Dichlorobenzene)	-----[c]	17,000[b]	-----[c]	340[b]	2	11	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
91-94-1	3,3'-Dichlorobenzidine	13[e]	-----[c]	280[e]	-----[c]	0.007[e,f]	0.033	1.3
75-34-3	1,1-Dichloroethane	200,000[b]	1,700[d]	200,000[b]	130[b]	23[b]	110	*
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	63[e]	0.70[e]	1,400[e]	0.99[e]	0.02	0.1	*
75-35-4	1,1-Dichloroethylene	18,000[b]	1,500[d]	1,800[b]	1,500[d]	0.06	0.3	*
156-59-2	*cis*-1,2-Dichloroethylene	20,000[b]	1,200[d]	20,000[b]	1,200[d]	0.4	1.1	*
156-60-5	*trans*-1,2-Dichloroethylene	41,000[b]	3,100[d]	41,000[b]	3,100[d]	0.7	3.4	*
78-87-5	1,2-Dichloropropane	84[e]	23[b]	1,800[e]	0.50[b]	0.03	0.15	*
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*)	33[e]	0.23[e]	610[b]	0.33[e]	0.004[e]	0.02	0.005
60-57-1	Dieldrin[n]	0.4[e]	2.2[e]	7.8[e]	3.1[e]	0.004[e]	0.02	0.0013
84-66-2	Diethyl phthalate	1,000,000[b]	2,000[d]	1,000,000[b]	2,000[d]	470[b]	470	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction[l] Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
105-67-9	2,4-Dimethylphenol	41,000[b]	-----[c]	41,000[b]	-----[c]	9[b]	9	*
121-14-2	2,4-Dinitrotoluene	8.4[e]	-----[c]	180[e]	-----[c]	0.0008[e,f]	0.0008	0.013
606-20-2	2,6-Dinitrotoluene	8.4[e]	-----[c]	180[e]	-----[c]	0.0007[e,f]	0.0007	0.0067
117-84-0	Di-*n*-octyl phthalate	41,000[c]	10,000[d]	4,100[b]	10,000[d]	10,000[d]	10,000[d]	*
115-29-7	Endosulfan	12,000[b]	-----[c]	1,200[b]	-----[c]	18[b]	90	*
145-73-3	Endothall[o]	41,000[c]	-----[c]	4,100[b]	-----[c]	0.4	0.4	NA
72-20-8	Endrin	610[b]	-----[c]	61[b]	-----[c]	1	5	*
100-41-4	Ethylbenzene	200,000[b]	400[d]	20,000[b]	58[b]	13	19	*
206-44-0	Fluoranthene	82,000[b]	-----[c]	82,000[b]	-----[c]	4,300[b]	21,000	*
86-73-7	Fluorene	82,000[b]	-----[c]	82,000[b]	-----[c]	560[b]	2,800	*
76-44-8	Heptachlor	1[e]	11[e]	28[e]	16[e]	23	110	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
105-67-9	2,4-Dimethylphenol	41,000[b]	-----[c]	41,000[b]	-----[c]	9[b]	9	*
121-14-2	2,4-Dinitrotoluene	8.4[e]	-----[c]	180[e]	-----[c]	0.0008[e,f]	0.0008	0.013
606-20-2	2,6-Dinitrotoluene	8.4[e]	-----[c]	180[e]	-----[c]	0.0007[e,f]	0.0007	0.0067
117-84-0	Di-*n*-octyl phthalate	41,000[e]	10,000[d]	4,100[b]	10,000[d]	10,000[d]	10,000[d]	*
115-29-7	Endosulfan	12,000[b]	-----[c]	1,200[b]	-----[c]	18[b]	90	*
145-73-3	Endothall[o]	41,000[c]	-----[c]	4,100[b]	-----[c]	0.4	0.4	NA
72-20-8	Endrin	610[b]	-----[c]	61[b]	-----[c]	1	5	*
100-41-4	Ethylbenzene	200,000[b]	400[d]	20,000[b]	58[b]	13	19	*
206-44-0	Fluoranthene	82,000[b]	-----[c]	82,000[b]	-----[c]	4,300[b]	21,000	*
86-73-7	Fluorene	82,000[b]	-----[c]	82,000[b]	-----[c]	560[b]	2,800	*
76-44-8	Heptachlor	1[e]	11[e]	28[e]	16[e]	23	110	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
1024-57-3	Heptachlor epoxide	0.6[e]	9.2[e]	2.7[b]	13[e]	0.7	3.3	*
118-74-1	Hexachlorobenzene	4[e]	1.8[e]	78[e]	2.6[e]	2	11	*
319-84-6	*alpha*-HCH (*alpha*-BHC)	0.9[e]	1.5[e]	20[e]	2.1[e]	0.0005[e,f]	0.003	0.002
58-89-9	*gamma*-HCH (Lindane)[n]	4[e]	-----[c]	96[e]	-----[c]	0.009	0.047	*
77-47-4	Hexachlorocyclopentadiene	14,000[b]	16[b]	14,000[b]	1.1[b]	400	2,200[d]	*
67-72-1	Hexachloroethane	2,000[b]	-----[c]	2,000[b]	-----[c]	0.5[b]	2.6	*
193-39-5	Indeno(1,2,3-*c,d*)pyrene	8[e]	-----[c]	170[e]	-----[c]	14	69	*
78-59-1	Isophorone	410,000[b]	4,600[d]	410,000[b]	4,600[d]	8[b]	8	*
72-43-5	Methoxychlor	10,000[b]	-----[c]	1,000[b]	-----[c]	160	780	*
74-83-9	Methyl bromide (Bromomethane)	2,900[b]	15[b]	1,000[b]	3.9[b]	0.2[b]	1.2	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
75-09-2	Methylene chloride (Dichloromethane)	760[e]	24[e]	12,000[b]	34[e]	0.02[e]	0.2	*
95-48-7	2-Methylphenol (*o* - Cresol)	100,000[b]	-----[c]	100,000[b]	-----[c]	15[b]	15	*
86-30-6	*N*-Nitrosodiphenylamine	1,200[e]	-----[c]	25,000[e]	-----[c]	1[e]	5.6	0.66
621-64-7	*N*-Nitrosodi-*n*-propylamine	0.8[e]	-----[c]	18[e]	-----[c]	0.00005[e,f]	0.00005	0.66
91-20-3	Naphthalene	82,000[b]	-----[c]	8,200[b]	-----[c]	84[b]	420	*
98-95-3	Nitrobenzene	1,000[b]	140[b]	1,000[b]	9.4[b]	0.1[b,f]	0.1	0.26
108-95-2	Phenol	1,000,000[b]	-----[c]	120,000[b]	-----[c]	100[b]	100	*
1918-02-1	Picloram[o]	140,000[b]	-----[c]	14,000[b]	-----[c]	2	20	NA
1336-36-3	Polychlorinated biphenyls (PCBs)[n]	1; 10; 25[h]	-----[c,h]	1[h]	-----[c,h]	-----[h]	-----[h]	*
129-00-0	Pyrene	61,000[b]	-----[c]	61,000[b]	-----[c]	4,200[b]	21,000	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
122-34-9	Simazine[o]	10,000[b]	-----[c]	1,000[b]	-----[c]	0.04	0.37	NA
100-42-5	Styrene	410,000[b]	1,500[d]	41,000[b]	430[b]	4	18	*
127-18-4	Tetrachloroethylene (Perchloroethylene)	110[e]	20[e]	2,400[e]	28[e]	0.06	0.3	*
108-88-3	Toluene	410,000[b]	650[d]	410,000[b]	42[b]	12	29	*
8001-35-2	Toxaphene[n]	5.2[e]	170[e]	110[e]	240[e]	31	150	*
120-82-1	1,2,4-Trichlorobenzene	20,000[b]	3,200[d]	2,000[b]	920[b]	5	53	*
71-55-6	1,1,1-Trichloroethane	-----[c]	1,200[d]	-----[c]	1,200[d]	2	9.6	*
79-00-5	1,1,2-Trichloroethane	8,200[b]	1,800[d]	8,200[b]	1,800[d]	0.02	0.3	*
79-01-6	Trichloroethylene	520[e]	8.9[e]	1,200[b]	12[e]	0.06	0.3	*
108-05-4	Vinyl acetate	1,000,000[b]	1,600[b]	200,000[b]	10[b]	170[b]	170	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction[l] Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
75-01-4	Vinyl chloride	3[e]	0.06[e]	65[e]	0.08[e]	0.01[f]	0.07	*
108-38-3	m-Xylene	1,000,000	420[d]	410,000[b]	420[d]	210	210	*
95-47-6	o-Xylene	1,000,000	410[d]	410,000[b]	410[d]	190	190	*
106-42-3	p-Xylene	1,000,000	460[d]	410,000[b]	460[d]	200	200	*
1330-20-7	Xylenes (total)	1,000,000[b]	410[d]	410,000[b]	410[d]	150	150	*
	Ionizable Organics							
65-85-0	Benzoic Acid	1,000,000[b]	-----[c]	820,000[b]	-----[c]	400[b,i]	400[i]	*
95-57-8	2-Chlorophenol	10,000[b]	53,000[d]	10,000[b]	53,000[d]	4[b,i]	20[i]	*
120-83-2	2,4-Dichlorophenol	6,100[b]	-----[c]	610[b]	-----[c]	1[b,i]	1[i]	*
51-28-5	2,4-Dinitrophenol	4,100[b]	-----[c]	410[b]	-----[c]	0.2[b,f,i]	0.2[i]	3.3
88-85-7	Dinoseb[o]	2,000[b]	-----[c]	200[b]	-----[c]	0.34[b,i]	3.4[i]	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/kg)	Class II (mg/kg)	ADL (mg/kg)
87-86-5	Pentachlorophenol	24[e,j]	-----[c]	520[e,j]	-----[c]	0.03[f,i]	0.14[i]	2.4
93-72-1	2,4,5-TP (Silvex)	16,000[b]	-----[c]	1,600[b]	-----[c]	11[i]	55[i]	*
95-95-4	2,4,5-Trichlorophenol	200,000[b]	-----[c]	200,000[b]	-----[c]	270[b,i]	1,400[i]	*
88-06-2	2,4,6- Trichlorophenol	520[e]	390[e]	11,000[e]	540[e]	0.2[e,f,i]	0.77[i]	0.43

CAS No.	Chemical Name	Exposure Route-Specific Values for Soils: Industrial-Commercial Ingestion (mg/kg)	Industrial-Commercial Inhalation (mg/kg)	Construction Worker Ingestion (mg/kg)	Construction Worker Inhalation (mg/kg)	Soil Component of the Groundwater Ingestion Exposure Route Values: Class I (mg/L)	Class II (mg/L)	
	Inorganics							
7440-36-0	Antimony	820[b]	-----[c]	82[b]	-----[c]	0.006[m]	0.024[m]	*
7440-38-2	Arsenic[l,n]	3[e,t]	1,200[e]	61[b]	25,000[e]	0.05[m]	0.2[m]	
7440-39-3	Barium	140,000[b]	910,000[b]	14,000[b]	870,000[b]	2.0[m]	2.0[m]	*
7440-41-7	Beryllium	1[e,t]	2,100[e]	29[e]	44,000[e]	0.004[m]	0.5[m]	*
7440-42-8	Boron	180,000[b]	1,000,000	18,000[b]	1,000,000	2.0[m]	2.0[m]	*
7440-43-9	Cadmium[l,n]	2,000[b,r]	2,800[e]	200[b,r]	59,000[e]	0.005[m]	0.05[m]	*
16887-00-6	Chloride	-------[c]	-----[c]	-----[c]	-----[c]	200[m]	200[m]	*
7440-47-3	Chromium, total	10,000[b]	420[e]	4,100[b]	8,800[e]	0.1[m]	1.0[m]	*
16065-83-1	Chromium, ion, trivalent	1,000,000[b]	-----[c]	330,000[b]	-----[c]	-----[g]	-----[g]	*
18540-29-9	Chromium, ion, hexavalent	10,000[b]	420[e]	4,100[b]	8,800[e]	-----	-----	*

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L)	Class II (mg/L)	
7440-48-4	Cobalt	120,000[b]	-----[c]	12,000[b]	-----[c]	1.0[m]	1.0[m]	*
7440-50-8	Copper[n]	82,000[b]	-----[c]	8,200[b]	-----[c]	0.65[m]	0.65[m]	*
57-12-5	Cyanide (amenable)	41,000[b]	-----[c]	4,100[b]	-----[c]	0.2[q]	0.6[q]	*
7782-41-4	Fluoride	120,000[b]	-----[c]	12,000[b]	-----[c]	4.0[m]	4.0[m]	*
15438-31-0	Iron	-----[c]	-----[c]	-----[c]	-----[c]	5.0[m]	5.0[m]	*
7439-92-1	Lead	400[k]	-----[c]	400[k]	-----[c]	0.0075[m]	0.1[m]	*
7439-96-5	Manganese	96,000[b]	91,000[b]	9,600[b]	8,700[b]	0.15[m]	10.0[m]	*
7439-97-6	Mercury[l,n]	610[b]	540,000[b]	61[b,s]	52,000[b]	0.002[m]	0.01[m]	*
7440-02-0	Nickel[l]	41,000[b]	21,000[e]	4,100[b]	440,000[e]	0.1[m]	2.0[m]	*
14797-55-8	Nitrate as N[p]	1,000,000[b]	-----[c]	330,000[b]	-----[c]	10.0[q]	100[q]	*
7782-49-2	Selenium[l,n]	10,000[b]	-----[c]	1,000[b]	-----[c]	0.05[m]	0.05[m]	*

(((

		Exposure Route-Specific Values for Soils				Soil Component of the Groundwater Ingestion Exposure Route Values		
		Industrial-Commercial		Construction Worker				
CAS No.	Chemical Name	Ingestion (mg/kg)	Inhalation (mg/kg)	Ingestion (mg/kg)	Inhalation (mg/kg)	Class I (mg/L)	Class II (mg/L)	
7440-22-4	Silver	10,000[b]	-----[c]	1,000[b]	-----[c]	0.05[m]	-----	*
14808-79-8	Sulfate	-----[c]	-----[c]	-----[c]	-----[c]	400[m]	400[m]	*
7440-28-0	Thallium	160[b,u]	-----[c]	160[b,u]	-----[c]	0.002[m]	0.02[m]	*
7440-62-2	Vanadium	14,000[b]	-----[c]	1,400[b]	-----[c]	0.049[m]	-----	*
7440-66-6	Zinc[l]	610,000[b]	-----[c]	61,000[b]	-----[c]	5.0[m]	10[m]	*

"*" indicates that the ADL is less than or equal to the specified remediation objective.

NA means Not Available; no PQL or EQL available in USEPA analytical methods.

Chemical Name and Soil Remediation Objective Notations (2nd, 5th thru 8th Columns)

[a] Soil remediation objectives based on human health criteria only.
[b] Calculated values correspond to a target hazard quotient of 1.
[c] No toxicity criteria available for this route of exposure.
[d] Soil saturation concentration ($C_{[sat]}$) = the concentration at which the absorptive limits of the soil particles, the solubility limits of the available soil moisture, and saturation of soil pore air have been reached. Above the soil saturation concentration, the assumptions regarding vapor transport to air and/or dissolved phase transport to groundwater (for chemicals which are liquid at ambient soil temperatures) have been violated, and alternative modeling approaches are required.
[e] Calculated values correspond to a cancer risk level of 1 in 1,000,000.
[f] Level is at or below Contract Laboratory Program required quantitation limit for Regular Analytical Services (RAS).
[g] Chemical-specific properties are such that this route is not of concern at any soil contaminant concentration.
[h] A preliminary goal of 1 ppm has been set for PCBs based on *Guidance on Remedial Actions for Superfund Sites with PCB Contamination*, EPA/540G-90/007, and on USEPA efforts to manage PCB contamination. See 40 CFR 761.120 for USEPA "PCB Spill Cleanup Policy." This regulation goes on to say that the remediation goal for an unrestricted area is 10 ppm and 25 ppm for a restricted area, provided both have at least 10 inches of clean cover.
[i] Soil remediation objective for pH of 6.8. If soil pH is other than 6.8, refer to Appendix B, Tables C and D in this Part.
[j] Ingestion soil remediation objective adjusted by a factor of 0.5 to account for dermal route.
[k] A preliminary remediation goal of 400 mg/kg has been set for lead based on *Revised Interim Soil Lead Guidance for CERCLA Sites and RCRA Corrective Action Facilities*, OSWER Directive #9355.4-12.
[l] Potential for soil-plant-human exposure.
[m] The person conducting the remediation has the option to use: (1) TCLP or SPLP test results to compare with the remediation objectives listed in this Table; or (2) the total amount of contaminant in the soil sample results to compare with pH specific remediation objectives listed in Appendix B, Table C or D of this Part. (See Section 742.510.) If the person conducting the remediation wishes to calculate soil remediation objectives based on background concentrations, this should be done in accordance with Subpart D of this Part.
[n] The Agency reserves the right to evaluate the potential for remaining contaminant concentrations to pose significant threats to crops, livestock, or wildlife.
[o] For agrichemical facilities, remediation objectives for surficial soils which are based on field application rates may be more appropriate for currently registered pesticides. Consult the Agency for further information.
[p] For agrichemical facilities, soil remediation objectives based on site-specific background concentrations of Nitrate as N may be more appropriate. Such determinations shall be conducted in accordance with the located in Subparts D and I of this Part.
[q] The TCLP extraction must be done using water at a pH of 7.0.
r Value based on dietary Reference Dose.
s Value based on Reference Dose for Mercuric chloride (CAS No. 7487-94-7).
t Note that Table value is likely to be less than background concentration for this chemical; screening or remediation concentrations using the procedures of Subpart D of this Part.

[u] Value based on Reference Dose for thallium sulfate (CAS No. 7446-18-6).

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.Table C: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class I Groundwater)

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Inorganics									
Antimony	5	5	5	5	5	5	5	5	5
Arsenic	25	26	27	28	29	29	29	30	31
Barium	260	490	850	1,200	1,500	1,600	1,700	1,800	2,100
Beryllium	1.1	2.1	3.4	6.6	22	63	140	1,000	8,000
Cadmium	1.0	1.7	2.7	3.7	5.2	7.5	11	59	430
Chromium (+6)	70	62	54	46	40	38	36	32	28
Copper	330	580	2,100	11,000	59,000	130,000	200,000	330,000	330,000
Cyanide	40	40	40	40	40	40	40	40	40
Mercury	0.01	0.01	0.03	0.15	0.89	2.1	3.3	6.4	8.0
Nickel	20	36	56	76	100	130	180	700	3,800
Selenium	24	17	12	8.8	6.3	5.2	4.5	3.3	2.4
Silver	0.24	0.33	0.62	1.5	4.4	8.5	13	39	110

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Thallium	1.6	1.8	2.0	2.4	2.6	2.8	3.0	3.4	3.8
Vanadium	980	980	980	980	980	980	980	980	980
Zinc	1,000	1,800	2,600	3,600	5,100	6,200	7,500	16,000	53,000
Organics									
Benzoic Acid	440	420	410	400	400	400	400	400	400
2-Chlorophenol	4.0	4.0	4.0	4.0	3.9	3.9	3.9	3.6	3.1
2,4-Dichlorophenol	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.86	0.69
Dinoseb	8.4	4.5	1.9	0.82	0.43	0.34	0.31	0.27	0.25
Pentachlorophenol	0.54	0.32	0.15	0.07	0.04	0.03	0.02	0.02	0.02
2,4,5-TP (Silvex)	26	16	12	11	11	11	11	11	11
2,4,5-Trichlorophenol	400	390	390	370	320	270	230	130	64
2,4,6-Trichlorophenol	0.37	0.36	0.34	0.29	0.20	0.15	0.13	0.09	0.07

SOURCE: Amended at 22 Ill. Reg. 10874, effective June 8, 1998.

Section 742.APPENDIX B Tier I Tables and Illustrations

Section 742.Table D: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class II Groundwater)

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Inorganics									
Antimony	20	20	20	20	20	20	20	20	20
Arsenic	100	100	100	110	110	120	120	120	120
Barium	260	490	850	1,200	1,500	1,600	1,700	1,800	2,100
Beryllium	140	260	420	820	2,800	7,900	17,000	130,000	1,000,000
Cadmium	10	17	27	37	52	75	110	590	4,300
Chromium (+6)	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Copper	330	580	2,100	11,000	59,000	130,000	200,000	330,000	330,000
Cyanide	120	120	120	120	120	120	120	120	120
Mercury	0.05	0.06	0.14	0.75	4.4	10	16	32	40
Nickel	400	730	1,100	1,500	2,000	2,600	3,500	14,000	76,000
Selenium	24	17	12	8.8	6.3	5.2	4.5	3.3	2.4
Thallium	16	18	20	24	26	28	30	34	38
Zinc	2,000	3,600	5,200	7,200	10,000	12,000	15,000	32,000	110,000

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Organics									
Benzoic Acid	440	420	410	400	400	400	400	400	400
2-Chlorophenol	20	20	20	20	20	20	19	3.6	3.1
2,4-Dichlorophenol	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.86	0.69
Dinoseb	84	45	19	8.2	4.3	3.4	3.1	2.7	2.5
Pentachlorophenol	2.7	1.6	0.75	0.33	0.18	0.15	0.12	0.11	0.10
2,4,5-TP (Silvex)	130	79	62	57	55	55	55	55	55
2,4,5-Trichlorophenol	2,000	2,000	1,900	1,800	1,600	1,400	1,200	640	64
2,4,6-Trichlorophenol	1.9	1.8	1.7	1.4	1.0	0.77	0.13	0.09	0.07

SOURCE: Amended at 22 Ill. Reg. 10847, effective, June 8, 1998.

Section 742.APPENDIX B
Section 742.Table D: pH Specific Soil Remediation Objectives for Inorganics and Ionizing Organics for the Soil Component of the Groundwater Ingestion Route (Class II Groundwater)

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Inorganics									
Antimony	20	20	20	20	20	20	20	20	20
Arsenic	100	100	100	110	110	120	120	120	120
Barium	260	490	850	1,200	1,500	1,600	1,700	1,800	2,100
Beryllium	140	260	420	820	2,800	7,900	17,000	130,000	1,000,000

Cadmium	10	17	27	37	52	75	110	590	4,300
Chromium (+6)	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data	No Data
Copper	330	580	2,100	11,000	59,000	130,000	200,000	330,000	330,000
Cyanide	120	120	120	120	120	120	120	120	120
Mercury	0.05	0.06	0.14	0.75	4.4	10	16	32	40
Nickel	400	730	1,100	1,500	2,000	2,600	3,500	14,000	76,000
Selenium	24	17	12	8.8	6.3	5.2	4.5	3.3	2.4
Thallium	16	18	20	24	26	28	30	34	38
Zinc	2,000	3,600	5,200	7,200	10,000	12,000	15,000	32,000	110,000

Chemical (totals) (mg/kg)	pH 4.5 to 4.74	pH 4.75 to 5.24	pH 5.25 to 5.74	pH 5.75 to 6.24	pH 6.25 to 6.64	pH 6.65 to 6.89	pH 6.9 to 7.24	pH 7.25 to 7.74	pH 7.75 to 8.0
Organics									
Benzoic Acid	440	420	410	400	400	400	400	400	400
2-Chlorophenol	20	20	20	20	20	20	19	3.6	3.1
2,4-Dichlorophenol	1.0	1.0	1.0	1.0	1.0	1.0	1.0	0.86	0.69
Dinoseb	84	45	19	8.2	4.3	3.4	3.1	2.7	2.5
Pentachlorophenol	2.7	1.6	0.75	0.33	0.18	0.15	0.12	0.11	0.10
2,4,5-TP (Silvex)	130	79	62	57	55	55	55	55	55
2,4,5-Trichlorophenol	2,000	2,000	1,900	1,800	1,600	1,400	1,200	640	64
2,4,6-Trichlorophenol	0.37	0.36	0.34	0.26	0.20	0.15	0.13	0.09	0.07

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.TABLE E: Tier 1 Groundwater Remediation Objectives for the Groundwater Component of the Groundwater Ingestion Route

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
83-32-9	Acenaphthene	0.42	2.1
67-64-1	Acetone	0.7	0.7
15972-60-8	Alachlor	0.002[c]	0.01[c]
116-06-3	Aldicarb	0.003[c]	0.015[c]
309-00-2	Aldrin	0.00004[a]	0.0002
120-12-7	Anthracene	2.1	10.5
1912-24-9	Atrazine	0.003[c]	0.015[c]
71-43-2	Benzene	0.005[c]	0.025[c]
56-55-3	Benzo(*a*)anthracene	0.00013[a]	0.00065
205-99-2	Benzo(*b*)fluoranthene	0.00018[a]	0.0009
207-08-9	Benzo(*k*)fluroanthene	0.00017[a]	0.00085
50-32-8	Benzo(*a*)pyrene	0.0002[a,c]	0.002[c]
111-44-4	Bis(2-chloroethyl)ether	0.01[a]	0.01
117-81-7	Bis(2-ethylhexyl)phthalate	0.006[a,c]	0.06[c]
75-27-4	Bromodichloromethane (Dichlorobromomethane)	0.00002[a]	0.00002
75-25-2	Bromoform	0.0002[a]	0.0002
71-36-3	Butanol	0.7	0.7
85-68-7	Butyl benzyl phthalate	1.4	7.0
86-74-8	Carbazole	---	---
1563-66-2	Carbofuran	0.04[c]	0.2[c]
75-15-0	Carbon disulfide	0.7	3.5
56-23-5	Carbon tetrachloride	0.005[c]	0.025[c]
57-74-9	Chlordane	0.002[c]	0.01[c]

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
108-90-7	Chlorobenzene (Monochlorobenzene)	0.1[c]	0.5[c]
124-48-1	Chlorodibromomethane (Dibromochloromethane)	0.14	0.14
67-66-3	Chloroform	0.00002[a]	0.0001
218-01-9	Chrysene	0.0015[a]	0.0075
94-75-7	2,4-D	0.07[c]	0.35[c]
75-99-0	Dalapon	0.2[c]	2.0[c]
72-54-8	DDD	0.00011[a]	0.00055
72-55-9	DDE	0.00004[a]	0.0002
50-29-3	DDT	0.00012[a]	0.0006
53-70-3	Dibenzo(*a,h*)anthracene	0.0003[a]	0.0015
96-12-8	1,2-Dibromo-3-chloropropane	0.0002[c]	0.0002[c]
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.00005[a,c]	0.0005[c]
84-74-2	Di-*n*-butyl phthalate	0.7	3.5
95-50-1	1,2-Dichlorobenzene (*o* - Dichlorobenzene)	0.6[c]	1.5[c]
106-46-7	1,4-Dichlorobenzene (*p* - Dichlorobenzene)	0.075[c]	0.375[c]
91-94-1	3,3'-Dichlorobenzidine	0.02[a]	0.1
75-34-3	1,1-Dichloroethane	0.7	3.5
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	0.005[c]	0.025[c]
75-35-4	1,1-Dichloroethylene[b]	0.007[c]	0.035[c]
156-59-2	*cis*-1,2-Dichloroethylene	0.07[c]	0.2[c]
156-60-5	*trans*-1,2-Dichloroethylene	0.1[c]	0.5[c]
78-87-5	1,2-Dichloropropane	0.005[c]	0.025[c]
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*)	0.001[a]	0.005

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
60-57-1	Dieldrin	0.00002[a]	0.0001
84-66-2	Diethyl phthalate	5.6	5.6
121-14-2	2,4-Dinitrotoluene[a]	0.00002	0.00002
606-20-2	2,6-Dinitrotoluene[a]	0.0001	0.0001
88-85-7	Dinoseb	0.007[c]	0.07[c]
117-84-0	Di-*n*-octyl phthalate	0.14	0.7
115-29-7	Endosulfan	0.042	0.21
145-73-3	Endothall	0.1[c]	0.1[c]
72-20-8	Endrin	0.002[c]	0.01[c]
100-41-4	Ethylbenzene	0.7[c]	1.0[c]
206-44-0	Fluoranthene	0.28	1.4
86-73-7	Fluorene	0.28	1.4
76-44-8	Heptachlor	0.0004[c]	0.002[c]
1024-57-3	Heptachlor epoxide	0.0002[c]	0.001[c]
118-74-1	Hexachlorobenzene	0.00006[a]	0.0003
319-84-6	*alpha*-HCH (*alpha*-BHC)	0.00003[a]	0.00015
58-89-9	*gamma*-HCH (Lindane)	0.0002[c]	0.001[c]
77-47-4	Hexachlorocyclopentadiene	0.05[c]	0.5[c]
67-72-1	Hexachloroethane	0.007	0.035
193-39-5	Indeno(1,2,3-*c,d*)pyrene	0.00043[a]	0.00215
78-59-1	Isophorone	1.4	1.4
72-43-5	Methoxychlor	0.04[c]	0.2[c]
74-83-9	Methyl bromide (Bromomethane)	0.0098	0.049
75-09-2	Methylene chloride (Dichloromethane)	0.005[c]	0.05[c]
91-20-3	Naphthalene[2]	0.025	0.039
98-95-3	Nitrobenzene[2]	0.0035	0.0035

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
1918-02-1	Picloram	0.5[c]	5.0[c]
1336-36-3	Polychlorinated biphenyls (PCBs)[n]	0.0005[c]	0.0025[c]
129-00-0	Pyrene	0.21	1.05
122-34-9	Simazine	0.004[c]	0.04[c]
100-42-5	Styrene	0.1[c]	0.5[c]
93-72-1	2,4,5-TP (Silvex)	0.05[c]	0.25[c]
127-18-4	Tetrachloroethylene (Perchloroethylene)	0.005[c]	0.025[c]
108-88-3	Toluene	1.0[c]	2.5[c]
8001-35-2	Toxaphene	0.003[c]	0.015[c]
120-82-1	1,2,4-Trichlorobenzene	0.07[c]	0.7[c]
71-55-6	1,1,1-Trichloroethane[2]	0.2[c]	1.0[c]
79-00-5	1,1,2-Trichloroethane	0.005[c]	0.05[c]
79-01-6	Trichloroethylene	0.005[c]	0.025[c]
108-05-4	Vinyl acetate	7.0	7.0
75-01-4	Vinyl chloride	0.002[c]	0.01[c]
1330-20-7	Xylenes (total)	10.0[c]	10.0[c]
	Ionizable Organics		
65-85-0	Benzoic Acid	28	28
106-47-8	4-Chloroaniline (*p*-Chloroaniline)	0.028	0.028
95-57-8	2-Chlorophenol	0.035	0.175
120-83-2	2,4-Dichlorophenol	0.021	0.021
105-67-9	2,4-Dimethylphenol	0.14	0.14
51-28-5	2,4-Dinitrophenol	0.014	0.014
95-48-7	2-Methylphenol (*o* - Cresol)	0.35	0.35
86-30-6	*N*-Nitrosodiphenylamine	0.01[a]	0.05

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
621-64-7	*N*-Nitrosodi-*n*-propylamine	0.01[a]	0.01
87-86-5	Pentachlorophenol	0.001[a,c]	0.005[c]
108-95-2	Phenol	0.1[c]	0.1[c]
95-95-4	2,4,5-Trichlorophenol	0.7	3.5
88-06-2	2,4,6 Trichlorophenol	0.0064[a]	0.032
	Inorganics		
7440-36-0	Antimony	0.006[c]	0.024[c]
7440-38-2	Arsenic	0.05[c]	0.2[c]
7440-39-3	Barium	2.0[c]	2.0[c]
7440-41-7	Beryllium	0.004[c]	0.5[c]
7440-42-8	Boron	2.0[c]	2.0[c]
7440-43-9	Cadmium	0.005[c]	0.05[c]
16887-00-6	Chloride	200[c]	200[c]
7440-47-3	Chromium, total	0.1[c]	1.0[c]
18540-29-9	Chromium, ion, hexavalent	---	---
7440-48-4	Cobalt	1.0[c]	1.0[c]
7440-50-8	Copper	0.65[c]	0.65[c]
57-12-5	Cyanide	0.2[c]	0.6[c]
7782-41-4	Fluoride	4.0[c]	4.0[c]
15438-31-0	Iron	5.0[c]	5.0[c]
7439-92-1	Lead	0.0075[c]	0.1[c]
7439-96-5	Manganese	0.15[c]	10.0[c]
7439-97-6	Mercury	0.002[c]	0.01[c]
7440-02-0	Nickel	0.1[c]	2.0[c]
14797-55-8	Nitrate as N	10.0[c]	100[c]
7782-49-2	Selenium	0.05[c]	0.05[c]
7440-22-4	Silver	0.05[c]	---
14808-79-8	Sulfate	400[c]	400[c]

		Groundwater Remediation Objective	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
7440-28-0	Thallium	0.002[c]	0.02[c]
7440-62-2	Vanadium[2]	0.049	---
7440-66-6	Zinc	5.0[c]	10[c]

Chemical Name and Groundwater Remediation Objective Notations

[a] The groundwater Health Advisory concentration is equal to ADL for carcinogens.
[b] Oral Reference Dose and/or Reference Concentration under review by USEPA. Listed values subject to change.
[c] Value listed is also the Groundwater Quality Standard for this chemical pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.

Section 742.APPENDIX B: Tier 1 Tables and Illustrations

Section 742.TABLE F: Values Used to Calculate the Tier 1 Soil Remediation Objectives for the Soil Component of the Groundwater Ingestion Route

		GW_{obj} Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a]	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
83-32-9	Acenaphthene	2.0[b]	10
67-64-1	Acetone	4.0[b]	4.0
15972-60-8	Alachlor	0.002[c]	0.01[c]
116-06-3	Aldicarb	0.003[c]	0.015[c]
309-00-2	Aldrin	5.0E-6[b]	2.5E-5
120-12-7	Anthracene	10[b]	50
1912-24-9	Atrazine	0.003[c]	0.015[c]
71-43-2	Benzene	0.005[c]	0.025[c]
56-55-3	Benzo(*a*)anthracene	0.0001[b]	0.0005
205-99-2	Benzo(*b*)fluoranthene	0.0001[b]	0.0005
207-08-9	Benzo(*k*)fluroanthene	0.001[b]	0.005
50-32-8	Benzo(*a*)pyrene	0.0002[a,c]	0.002[c]
111-44-4	Bis(2-chloroethyl)ether	8.0E-5[b]	8.0E-5
117-81-7	Bis(2-ethylhexyl)phthalate	0.006[a,c]	0.06[c]
75-27-4	Bromodichloromethane (Dichlorobromomethane)	0.1[b]	0.1
75-25-2	Bromoform	0.1[b]	0.01
71-36-3	Butanol	4.0[b]	4.0
85-68-7	Butyl benzyl phthalate	7.0[b]	35
86-74-8	Carbazole	0.004[b]	0.02
1563-66-2	Carbofuran	0.04[c]	0.2[c]
75-15-0	Carbon disulfide	4.0[b]	20
56-23-5	Carbon tetrachloride	0.005[c]	0.025[c]
57-74-9	Chlordane	0.002[c]	0.01[c]

CAS No.	Chemical Name	GW$_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] Class I (mg/L)	Class II (mg/L)
108-90-7	Chlorobenzene (Monochlorobenzene)	0.1[c]	0.5[c]
124-48-1	Chlorodibromomethane (Dibromochloromethane)	0.06[b]	0.06
67-66-3	Chloroform	0.1[b]	0.5
218-01-9	Chrysene	0.1[b]	0.05
94-75-7	2,4-D	0.07[c]	0.35[c]
75-99-0	Dalapon	0.2[c]	2.0[c]
72-54-8	DDD	0.0004[b]	0.002
72-55-9	DDE	0.0003[b]	0.0015
50-29-3	DDT	0.0003[b]	0.0015
53-70-3	Dibenzo(*a,h*)anthracene	1.0E-5[b]	5.0E-5
96-12-8	1,2-Dibromo-3-chloropropane	0.0002[c]	0.0002[c]
106-93-4	1,2-Dibromoethane (Ethylene dibromide)	0.00005[a,c]	0.0005[c]
84-74-2	Di-*n*-butyl phthalate	4.0[b]	20
95-50-1	1,2-Dichlorobenzene (*o* - Dichlorobenzene)	0.6[c]	1.5[c]
106-46-7	1,4-Dichlorobenzene (*p* - Dichlorobenzene)	0.075[c]	0.375[c]
91-94-1	3,3'-Dichlorobenzidine	0.0002[b]	0.001
75-34-3	1,1-Dichloroethane	4.0[b]	20
107-06-2	1,2-Dichloroethane (Ethylene dichloride)	0.005[c]	0.025[c]
75-35-4	1,1-Dichloroethylene	0.007[c]	0.035[c]
156-59-2	*cis*-1,2-Dichloroethylene	0.07[c]	0.2[c]
156-60-5	*trans*-1,2-Dichloroethylene	0.1[c]	0.5[c]
78-97-5	1,2-Dichloropropane	0.005[c]	0.025[c]
542-75-6	1,3-Dichloropropene (1,3-Dichloropropylene, *cis* + *trans*)	0.0005[b]	0.0025

		GW$_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a]	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
60-57-1	Dieldrin	5.0E-6[b]	2.5E-5
84-66-2	Diethyl phthalate	30[b]	30
121-14-2	2,4-Dinitrotoluene	0.0001[b]	0.0001
606-20-2	2,6-Dinitrotoluene	0.0001	0.0001
88-85-7	Dinoseb	0.007[c]	0.07[c]
117-84-0	Di-*n*-octyl phthalate	0.7[b]	3.5
115-29-7	Endosulfan	0.2[b]	1.0
145-73-3	Endothall	0.1[c]	0.1[c]
72-20-8	Endrin	0.002[c]	0.01[c]
100-41-4	Ethylbenzene	0.7[c]	1.0[c]
206-44-0	Fluoranthene	1.0[b]	5.0
86-73-7	Fluorene	1.0[b]	5.0
76-44-8	Heptachlor	0.0004[c]	0.002[c]
1024-57-3	Heptachlor epoxide	0.0002[c]	0.001[c]
118-74-1	Hexachlorobenzene	0.001[b]	0.005
319-84-6	*alpha*-HCH (*alpha*-BHC)	1.0E-5[b]	5.0E-5
58-89-9	*gamma*-HCH (Lindane)	0.0002[c]	0.001[c]
77-47-4	Hexachlorocyclopentadiene	0.05[c]	0.5[c]
67-72-1	Hexachloroethane	0.007	0.035
193-39-5	Indeno(1,2,3-*c,d*)pyrene	0.0001[b]	0.0005
78-59-1	Isophorone	1.4	1.4
72-43-5	Methoxychlor	0.04[c]	0.2[c]
74-83-9	Methyl bromide (Bromomethane)	0.05[b]	0.25
75-09-2	Methylene chloride (Dichloromethane)	0.005[c]	0.05[c]
91-20-3	Naphthalene	1.0[b]	5.0
98-95-3	Nitrobenzene	0.02[b]	0.02

CAS No.	Chemical Name	GW$_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a] Class I (mg/L)	Class II (mg/L)
1918-02-1	Picloram	0.5[c]	5.0[c]
1336-36-3	Polychlorinated biphenyls (PCBs)	---	---
129-00-0	Pyrene	1.0[b]	5.0
122-34-9	Simazine	0.004[c]	0.04[c]
100-42-5	Styrene	0.1[c]	0.5[c]
93-72-1	2,4,5-TP (Silvex)	0.05[c]	0.25[c]
127-18-4	Tetrachloroethylene (Perchloroethylene)	0.005[c]	0.025[c]
108-88-3	Toluene	1.0[c]	2.5[c]
8001-35-2	Toxaphene	0.003[c]	0.015[c]
120-82-1	1,2,4-Trichlorobenzene	0.07[c]	0.7[c]
71-55-6	1,1,1-Trichloroethane[2]	0.2[c]	1.0[c]
79-00-5	1,1,2-Trichloroethane	0.005[c]	0.05[c]
79-01-6	Trichloroethylene	0.005[c]	0.025[c]
108-05-4	Vinyl acetate	40[b]	40
75-01-4	Vinyl chloride	0.002[c]	0.01[c]
1330-20-7	Xylenes (total)	10.0[c]	10.0[c]
	Ionizable Organics		
65-85-0	Benzoic Acid	100[b]	100
106-47-8	4-Chloroaniline (*p*-Chloroaniline)	0.1[b]	0.1
95-57-8	2-Chlorophenol	0.2[b]	1.0
120-83-2	2,4-Dichlorophenol	0.1[b]	0.1
105-67-9	2,4-Dimethylphenol	0.7[b]	0.7
51-28-5	2,4-Dinitrophenol	0.04[b]	0.04
95-48-7	2-Methylphenol (*o* - Cresol)	2.0[b]	2.0
86-30-6	*N*-Nitrosodiphenylamine	0.02[b]	0.1

		GW$_{obj}$ Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a]	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
621-64-7	*N*-Nitrosodi-*n*-propylamine	1.0E-5[b]	1.0E-5
87-86-5	Pentachlorophenol	0.001[a,c]	0.005[c]
108-95-2	Phenol	0.1[c]	0.1[c]
95-95-4	2,4,5-Trichlorophenol	4.0[b]	20
88-06-2	2,4,6-Trichlorophenol	0.008[b]	0.04
	Inorganics		
7440-36-0	Antimony	0.006[c]	0.024[c]
7440-38-2	Arsenic	0.05[c]	0.2[c]
7440-39-3	Barium	2.0[c]	2.0[c]
7440-41-7	Beryllium	0.004[c]	0.5[c]
7440-42-8	Boron	2.0[c]	2.0[c]
7440-43-9	Cadmium	0.005[c]	0.05[c]
16887-00-6	Chloride	200[c]	200[c]
7440-47-3	Chromium, total	0.1[c]	1.0[c]
18540-29-9	Chromium, ion, hexavalent	---	---
7440-48-4	Cobalt	1.0[c]	1.0[c]
7440-50-8	Copper	0.65[c]	0.65[c]
57-12-5	Cyanide	0.2[c]	0.6[c]
7782-41-4	Fluoride	4.0[c]	4.0[c]
15438-31-0	Iron	5.0[c]	5.0[c]
7439-92-1	Lead	0.0075[c]	0.1[c]
7439-96-5	Manganese	0.15[c]	10.0[c]
7439-97-6	Mercury	0.002[c]	0.01[c]
7440-02-0	Nickel	0.1[c]	2.0[c]
14797-55-8	Nitrate as N	10.0[c]	100[c]
7782-49-2	Selenium	0.05[c]	0.05[c]
7440-22-4	Silver	0.05[c]	---
14808-79-8	Sulfate	400[c]	400[c]

		GW_{obj} Concentration used to Calculate Tier 1 Soil Rememdiation Objectives[a]	
CAS No.	Chemical Name	Class I (mg/L)	Class II (mg/L)
7440-28-0	Thallium	0.002[c]	0.02[c]
7440-62-2	Vanadium	0.049	---
7440-66-6	Zinc	5.0[c]	10[c]

Chemical Name and Groundwater Remediation Objective Notations

[a] The Equation S17 is used to calculate the Soil Remediation Objective for the Soil Component of the Groundwater Ingestion Route; this equation requires calculation of the Target Soil Leachate Concentration (C_w) from Equation S18: $C_w = DF \times GW_{obj}$.

[b] Value listed is the Water Health Based Limit (HBL) for this chemical from Soil Screening Guidance: User's Guide, incorporated by reference at Section 742.210; for carcinogens, the HBL is equal to a cancer risk of 1.0E-6, and for noncarcinogens is equal to a Hazard Quotient of 1.0. NOTE: These GW_{obj} concentrations are not equal to the Tier 1 Groundwater Remediation Objectives for the Direct Ingestion of Groundwater Component of the Groundwater Ingestion Route, listed in Section 742.Appendix B, Table E.

[c] Value listed is also the Groundwater Quality Standard for this chemical pursuant to 35 Ill. Adm. Code 620.410 for Class I Groundwater or 35 Ill. Adm. Code 620.420 for Class II Groundwater.

APPENDIX C

USEPA REGION 9 PRELIMINARY REMEDIATION GOALS

Key i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
8.7E-03 i	4.0E-03 i	8.7E-03 r	4.0E-03 r	0	0.10	30560-19-1	Acephate	5.1E+01 ca**	3.4E+02 ca*	7.7E-01 ca*	7.7E+00 ca*		6.0E+01
7.7E-03 r	2.6E-03 r	7.7E-03 i	2.6E-03 i	1	0.10	75-07-0	Acetaldehyde	9.2E+00 ca**	2.2E+01 ca**	8.7E-01 ca*	1.5E+00 ca*		
	2.0E-02 i		2.0E-02 r	0	0.10	34256-82-1	Acetochlor	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.0E-01 i		1.0E-01 r	1	0.10	67-64-1	Acetone	1.4E+03 nc	6.1E+03 nc	3.7E+02 nc	6.1E+02 nc	1.6E+01	8.0E-01
	8.0E-04 h		2.9E-03 x	0	0.10	75-86-5	Acetone cyanohydrin	4.4E+01 nc	8.6E+02 nc	1.0E+01 nc	2.9E+01 nc		
	6.0E-03 i		1.4E-02 h	1	0.10	75-05-8	Acetonitrile	2.0E+02 nc	1.3E+03 nc	5.2E+01 nc	7.1E+01 nc		
	1.0E-01 i		5.7E-06 x	1	0.10	98-86-2	Acetophenone	4.9E-01 nc	1.6E+00 nc	2.1E-02 nc	4.2E-02 nc		
1.1E-01 o	1.3E-02 i	1.1E-01 r	1.3E-02 r	0	0.10	50594-66-6	**Acifluorfen**	4.0E+00 ca	2.7E+01 ca	6.1E-02 ca	6.1E-01 ca		
	2.0E-02 h		5.7E-06 i	1	0.10	107-02-8	Acrolein	1.0E-01 nc	3.4E-01 nc	2.1E-02 nc	4.2E-02 nc		
4.6E+00 i	2.0E-04 i	4.6E+00 i	2.0E-04 r	0	0.10	79-06-1	Acrylamide	9.8E-02 ca	6.6E-01 ca	1.5E-03 ca	1.5E-02 ca		
	5.0E-01 i		2.9E-04 i	0	0.10	79-10-7	Acrylic acid	2.6E+04 nc	4.2E+05 nc	1.0E+00 nc	1.8E+04 nc		
5.4E-01 i	1.0E-03 h	2.4E-01 i	5.7E-04 i	1	0.10	107-13-1	Acrylonitrile	1.9E-01 ca*	4.9E-01 ca*	2.8E-02 ca*	3.7E+00 ca*		
8.1E-02 h	1.0E-02 i	8.0E-02 r	1.0E-02 r	0	0.10	15972-60-8	Alachlor	5.5E+00 ca*	3.7E+01 ca	8.4E-02 ca	8.4E-01 ca		
	1.5E-01 i		1.5E-01 r	0	0.10	1596-84-5	Alar	8.2E+03 nc	1.6E+05 nc	5.5E+02 nc	5.5E+03 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	116-06-3	Aldicarb	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	1646-88-4	Aldicarb sulfone	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
1.7E+01 i	3.0E-05 i	1.7E+01 i	3.0E-05 r	0	0.10	309-00-2	Aldrin	2.6E-02 ca*	1.8E-01 ca	3.9E-04 ca	4.0E-03 ca	1.2E+04	5.9E+02
	2.5E-01 i		2.5E-01 r	0	0.10	5585-64-8	Ally	1.4E+04 nc	1.0E+05 max	9.1E+02 nc	9.1E+03 nc		
	5.0E-03 x		5.0E-03 r	0	0.10	107-18-6	Allyl alcohol	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	5.0E-02 h		2.9E-04 i	0	0.10	107-05-1	Allyl chloride	2.7E+03 nc	5.2E+04 nc	1.0E+00 nc	1.8E+03 nc		
	1.0E+00 n			0	0.01	7429-90-5	Aluminum	7.5E+04 nc	1.0E+05 max		3.7E+04 nc		
	4.0E-04 i			0	0.01	20859-73-8	Aluminum phosphide	3.0E+01 nc	7.5E+02 nc		1.5E+01 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	67485-29-4	Amdro	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
	9.0E-03 i		9.0E-03 r	0	0.10	834-12-8	Ametryn	4.9E+02 nc	9.6E+03 nc	3.3E+01 nc	3.3E+02 nc		
	7.0E-02 h		7.0E-02 r	0	0.10	591-27-5	m-Aminophenol	3.8E+03 nc	7.5E+04 nc	2.6E+02 nc	2.6E+03 nc		
	2.0E-05 h		2.0E-05 r	0	0.10	504-24-5	4-Aminopyridine	1.1E+00 nc	2.1E+01 nc	7.3E-02 nc	7.3E-01 nc		
	2.5E-03 i		2.5E-03 r	0	0.10	33089-61-1	Amitraz	1.4E+02 nc	2.7E+03 nc	9.1E+00 nc	9.1E+01 nc		
			2.9E-02 i	n/a	n/a	7664-41-7	Ammonia			1.0E+02 nc			
	2.0E-01 i			0	0.10	7773-06-0	Ammonium sulfamate	1.1E+04 nc	1.0E+05 max		7.3E+03 nc		
5.7E-03 i	7.0E-03 n	5.7E-03 r	2.9E-04 i	0	0.10	62-53-3	**Aniline**	7.8E+01 ca**	5.3E+02 ca*	1.0E+00 nc	1.2E+01 ca*		
	4.0E-04 i			0	0.01	7440-36-0	Antimony and compounds	3.0E+01 nc	7.5E+02 nc		1.5E+01 nc	5.0E+00	3.0E-01
	5.0E-04 h			0	0.01	1314-60-9	Antimony pentoxide	3.7E+01 nc	9.4E+02 nc		1.8E+01 nc		
	9.0E-04 h			0	0.01	28300-74-5	Antimony potassium tartrate	6.7E+01 nc	1.7E+03 nc		3.3E+01 nc		
	4.0E-04 h			0	0.01	1332-81-6	Antimony tetroxide	3.0E+01 nc	7.5E+02 nc		1.5E+01 nc		
	4.0E-04 h			0	0.01	1309-64-4	Antimony trioxide	3.0E+01 nc	7.5E+02 nc		1.5E+01 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	74115-24-5	Apollo	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
2.5E-02 i	5.0E-02 h	2.5E-02 i	5.0E-02 r	0	0.10	140-57-8	Aramite	1.8E+01 ca	1.2E+02 ca	2.7E-01 ca	2.7E+00 ca		
	3.0E-04 i			0	0.03	7440-38-2	Arsenic (noncancer endpoint)	2.1E+01 nc	4.8E+02 nc				
1.5E+00 i	3.0E-04 i	1.5E+01 i		0	0.03	7440-38-2	Arsenic (cancer endpoint)	3.8E-01 ca*	3.0E+00 ca	4.5E-04 ca	4.5E-02 ca	2.9E+01	1.0E+00
			1.4E-05 i	n/a	n/a	7784-42-1	Arsine (see arsenic for cancer endpoint)			5.2E-02 nc			
	9.0E-03 i		9.0E-03 r	0	0.10	76578-12-6	Assure	4.9E+02 nc	9.6E+03 nc	3.3E+01 nc	3.3E+02 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	3337-71-1	Asulam	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.2E-01 h	3.5E-02 h	2.2E-01 r	3.5E-02 h	0	0.10	1912-24-9	Atrazine	2.0E+00 ca	1.3E+01 ca	3.1E-02 ca	3.0E-01 ca		
	4.0E-04 i		4.0E-04 r	0	0.10	71751-41-2	Avermectin B1	2.2E+01 nc	4.3E+02 nc	1.5E+00 nc	1.5E+01 nc		
1.1E-01 i		1.1E-01 i		0	0.10	103-33-3	Azobenzene	4.0E+00 ca	2.7E+01 ca	6.2E-02 ca	6.1E-01 ca		
	7.0E-02 i		1.4E-04 h	0	0.01	7440-39-3	**Barium and compounds**	5.2E+03 nc	1.0E+05 max	5.2E-01 nc	2.6E+03 nc	1.6E+03	8.2E+01
	4.0E-03 i		4.0E-03 r	0	0.10	114-26-1	Baygon	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc		
	3.0E-02 i		3.0E-02 r	0	0.10	43121-43-3	Bayleton	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	68359-37-5	Baythroid	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	3.0E-01 i		3.0E-01 r	0	0.10	1861-40-1	Benefin	1.6E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	17804-35-2	Benomyl	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	3.0E-02 i		3.0E-02 r	0	0.10	25057-89-0	**Bentazon**	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	100-52-7	Benzaldehyde	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
2.9E-02 i	3.0E-03 n	2.9E-02 i	1.7E-03 n	1	0.10	71-43-2	**Benzene**	6.2E-01 ca*	1.4E+00 ca*	2.3E-01 ca*	3.9E-01 ca*	3.0E-02	2.0E-03
2.3E+02 i	3.0E-03 i	2.3E+02 i	3.0E-03 r	0	0.10	92-87-5	Benzidine	1.9E-03 ca	1.3E-02 ca	2.9E-05 ca	2.9E-04 ca		
	4.0E+00 i		4.0E+00 i	0	0.10	65-85-0	Benzoic acid	1.0E+05 max	1.0E+05 max	1.5E+04 nc	1.5E+05 nc	4.0E+02	2.0E+01
1.3E+01 i		1.3E+01 r		0	0.10	98-07-7	Benzotrichloride	3.4E-02 ca	2.3E-01 ca	5.2E-04 ca	5.2E-03 ca		
	3.0E-01 h		3.0E-01 r	0	0.10	100-51-6	Benzyl alcohol	1.6E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
1.7E-01 i		1.7E-01 r		1	0.10	100-44-7	Benzyl chloride	8.1E-01 ca	2.2E+00 ca	4.0E-02 ca	6.6E-02 ca		
	2.0E-03 i	8.4E+00 i	5.7E-06 i	0	0.01	7440-41-7	**Beryllium and compounds**	1.5E+02 nc	3.4E+03 nc	8.0E-04 ca*	7.3E+01 nc	6.3E+01	3.0E+00
	1.0E-04 i		1.0E-04 r	0	0.10	141-66-2	Bidrin	5.5E+00 nc	1.0E+00 nc	3.7E-01 nc	3.7E+00 nc		
	1.5E-02 i		1.5E-02 r	0	0.10	82657-04-3	Biphenthrin (Talstar)	8.2E+02 nc	1.6E+04 nc	5.5E+01 nc	5.5E+02 nc		
	5.0E-02 i		5.0E-02 r	1	0.10	92-52-4	**1,1-Biphenyl**	2.3E+03 nc	2.4E+04 nc	1.8E+02 nc	3.0E+02 nc		
1.1E+00 i		1.2E+00 i		1	0.10	111-44-4	Bis(2-chloroethyl)ether	1.8E-01 ca	5.6E-01 ca	5.8E-03 ca	9.8E-03 ca	4.0E-04	2.0E-05
7.0E-02 h	4.0E-02 i	3.5E-02 h	4.0E-02 r	1	0.10	39638-32-9	Bis(2-chloroisopropyl)ether	2.5E+00 ca	7.4E+00 ca	1.9E-01 ca	2.7E-01 ca		
2.2E+02 i		2.2E+02 i		1	0.10	542-88-1	Bis(chloromethyl)ether	1.9E-04 ca	4.3E-04 ca	3.1E-05 ca	5.2E-05 ca		
7.0E-02 h		3.5E-02 h		0	0.10	108-60-1	Bis(2-chloro-1-methylethyl)ether	6.3E+00 ca	4.3E+01 ca	1.9E-01 ca	9.6E-01 ca		
1.4E-02 i	2.0E-02 i	1.4E-02 r	2.2E-02 r	0	0.10	117-81-7	Bis(2-ethylhexyl)phthalate (DEHP)	3.2E+01 ca*	2.1E+02 ca	4.8E-01 ca	4.8E+00 ca		
	5.0E-02 i		5.0E-02 r	0	0.10	80-05-7	Bisphenol A	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	9.0E-02 i		5.7E-03 h	0	0.10	7440-42-8	Boron	4.9E+03 nc	9.6E+04 nc	2.1E+01 nc	3.3E+03 nc		
			2.0E-04 h	0	0.10	7637-07-2	Boron trifluoride			7.3E-01 nc			
	2.0E-02 n		2.9E-03 n	1	0.10	SU 108-86-1	**Bromobenzene**	2.8E+01 nc	9.2E+01 nc	1.0E+01 nc	2.0E+01 nc		
6.2E-02 i	2.0E-02 i	6.2E-02 r	2.0E-02 r	1	0.10	75-27-4	Bromodichloromethane	9.8E-01 ca	2.3E+00 ca	1.1E-01 ca	1.8E-01 ca	6.0E-01	3.0E-02
7.9E-03 i	2.0E-02 i	3.9E-03 i	2.0E-02 r	0	0.10	75-25-2	Bromoform (tribromomethane)	5.6E+01 ca*	3.8E+02 ca*	1.7E+00 ca*	8.5E+00 ca*	8.0E-01	4.0E-02
	1.4E-03 i		1.4E-03 i	1	0.10	74-83-9	Bromomethane (Methyl bromide)	3.8E+00 nc	1.3E+01 nc	5.2E+00 nc	8.7E+00 nc	2.0E-01	1.0E-02
				0	0.10	101-55-3	4-Bromophenyl phenyl ether						
	5.0E-03 h		5.0E-03 r	0	0.10	2104-96-3	Bromophos	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	1689-84-5	Bromoxynil	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	1.8E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	1689-99-2	Bromoxynil octanoate	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
9.8E-01 r		9.8E-01 i		1	0.10	106-99-0	1,3-Butadiene	6.5E-03 ca	1.4E-02 ca	6.9E-03 ca	1.1E-02 ca		
	1.0E-01 i		1.0E-01 r	0	0.10	71-36-3	1-Butanol	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc	1.7E+01	9.0E-01
	5.0E-02 i		5.0E-02 r	0	0.10	2008-41-5	Butylate	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	1.0E-02 n		1.0E-02 r	1	0.10	104-51-8	**n-Butylbenzene**	1.3E+02 nc	5.5E+02 nc	3.7E+01 nc	6.1E+01 nc		
	1.0E-02 n		1.0E-02 r	1	0.10	135-9-88	**sec-Butylbenzene**	1.0E+02 nc	4.1E+02 nc	3.7E+01 nc	6.1E+01 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFI 1/(mg/kg-d)	RfDI (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	1.0E-02 n		1.0E-02 r	1	0.10	104-5-18	**tert-Butylbenzene**	1.2E+02 nc	4.9E+02 nc	3.7E+01 nc	6.1E+01 nc		
	2.0E-01 i		2.0E-01 r	0	0.10	85-68-7	Butyl benzyl phthalate	9.3E+02 sat	9.3E+02 sat	7.3E+02 nc	7.3E+03 nc	9.3E+02	8.1E+02
	1.0E+00 i		1.0E+00 r	0	0.10	85-70-1	Butylphthalyl butylglycolate	5.5E+04 nc	1.0E+05 max	3.7E+03 nc	3.7E+04 nc		
	3.0E-03 h		3.0E-03 r	0	0.10	75-60-5	Cacodylic acid	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
	5.0E-04 i	6.3E+00 i	5.7E-05 x	0	0.01	7440-43-9	Cadmium and compounds	3.7E+01 nc	9.3E+02 nc	1.1E-03 ca	1.8E+01 nc	8.0E+00	4.0E-01
							"CAL-Modified PRG" (PEA, 1994)	**9.0E+00**					
	5.0E-01 i		5.0E-01 r	0	0.10	105-60-2	Caprolactam	2.7E+04 nc	1.0E+05 max	1.8E+03 nc	1.8E+04 nc		
8.6E-03 h	2.0E-03 i	8.6E-03 r	2.0E-03 r	0	0.10	2425-06-1	Captafol	5.2E+01 ca**	3.5E+02 ca**	7.8E-01 ca*	7.8E+00 ca*		
3.5E-03 h	1.3E-01 i	3.5E-03 r	1.3E-01 r	0	0.10	133-06-2	Captan	1.3E+02 ca*	8.6E+02 ca	1.9E+00 ca	1.9E+01 ca		
	1.0E-01 i		1.1E-01 r	0	0.10	63-25-2	Carbaryl	5.5E+03 nc	1.1E+05 nc	4.0E+02 nc	3.7E+03 nc		
2.0E-02 h		2.0E-02 r		0	0.10	86-74-8	Carbazole	2.2E+01 ca	1.5E+02 ca	3.4E-01 ca	3.4E+00 ca	6.0E-01	3.0E-02
	5.0E-03 i		5.0E-03 r	0	0.10	1563-66-2	Carbofuran	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	1.0E-01 i		2.0E-01 i	1	0.10	75-15-0	**Carbon disulfide**	3.5E+02 nc	1.2E+03 nc	7.3E+02 nc	1.0E+03 nc	3.2E+01	2.0E+00
1.3E-01 i	7.0E-04 i	5.3E-02 i	5.7E-04 x	1	0.10	56-23-5	Carbon tetrachloride	2.3E-01 ca**	5.2E-01 ca*	1.3E-01 ca*	1.7E-01 ca*	7.0E-02	3.0E-03
	1.0E-02 i		1.0E-02 r	0	0.10	55285-14-8	Carbosulfan	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	5234-68-4	Carboxin	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	302-17-0	Chloral	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	1.5E-02 i		1.5E-02 r	0	0.10	133-90-4	Chloramben	8.2E+02 nc	1.6E+04 nc	5.5E+01 nc	5.5E+02 nc		
4.0E-01 h		4.0E-01 r		0	0.10	118-75-2	Chloranil	1.1E+00 ca	7.4E+00 ca	1.7E-02 ca	1.7E-01 ca		
3.5E-01 i	5.0E-04 i	3.5E-01 i	2.3E-05 i	0	0.04	57-74-9	**Chlordane**	1.6E+00 ca*	1.2E+01 ca*	1.9E-02 ca**	1.9E-01 ca*	1.0E+01	5.0E-01
	2.0E-02 i		2.0E-02 r	0	0.10	90982-32-4	Chlorimuron-ethyl	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.0E-01 i			0	0.01	7782-50-5	Chlorine				3.7E+03 nc		
			5.7E-05 i	n/a	n/a	10049-04-4	Chlorine dioxide			2.1E-01 nc			
				1	0.10	107-20-0	Chloroacetaldehyde						
	2.0E-03 h		2.0E-03 r	0	0.10	79-11-8	Chloroacetic acid	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	8.6E-06 r		8.6E-06 i	1	0.10	SU 532-27-4	2-Chloroacetophenone	3.2E-02 nc	1.1E-01 nc	3.1E-02 nc	5.2E-02 nc		
	4.0E-03 i		4.0E-03 r	0	0.10	106-47-8	4-Chloroaniline	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc	7.0E-01	3.0E-02
	2.0E-02 i		5.7E-03 h	1	0.10	108-90-7	Chlorobenzene	5.4E+01 nc	1.8E+02 nc	2.1E+01 nc	3.9E+01 nc	1.0E+00	7.0E-02
2.7E-01 h	2.0E-02 i	2.7E-01 h	2.0E-02 r	0	0.10	510-15-6	Chlorobenzilate	1.6E+00 ca	1.1E+01 ca	2.5E-02 ca	2.5E-01 ca		
	2.0E-01 h		2.0E-01 r	0	0.10	74-11-3	p-Chlorobenzoic acid	1.1E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
	2.0E-02 h		2.0E-02 r	0	0.10	98-56-6	4-Chlorobenzotrifluoride	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	2.0E-02 h		2.0E-03 h	1	0.10	126-99-8	2-Chloro-1,3-butadiene	3.6E+00 nc	1.2E+01 nc	7.3E+00 nc	1.4E+01 nc		
	4.0E-01 h		4.0E-01 r	1	0.10	SU 109-69-3	1-Chlorobutane	4.8E+02 sat	4.8E+02 sat	1.5E+03 nc	2.4E+03 nc		
	1.4E+01 r		1.4E+01 i	1	0.10	SU 75-68-3	1-Chloro-1,1-difluoroethane (HCFC-142b)	3.4E+02 sat	3.4E+02 sat	5.2E+04 nc	8.7E+04 nc		
	1.4E+01 r		1.4E+01 i	1	0.10	SU 75-45-6	Chlorodifluoromethane	3.4E+02 sat	3.4E+02 sat	5.1E+04 nc	8.5E+04 nc		
				1	0.10	110-75-8	2-Chloroethyl vinyl ether						
6.1E-03 i	1.0E-02 i	8.1E-02 i	1.0E-02 r	1	0.10	67-66-3	Chloroform	2.4E-01 ca	5.2E-01 ca	8.4E-02 ca	1.6E-01 ca	6.0E-01	3.0E-02
1.3E-02 h		6.3E-03 h		1	0.10	74-87-3	Chloromethane	1.2E+00 ca	2.6E+00 ca	1.1E+00 ca	1.5E+00 ca		
5.8E-01 h		5.8E-01 r		0	0.10	95-69-2	4-Chloro-2-methylaniline	7.7E-01 ca	5.2E+00 ca	1.2E-02 ca	1.2E-01 ca		
4.6E-01 h		4.6E-01 r		0	0.10	3165-93-3	4-Chloro-2-methylaniline hydrochloride	9.7E-01 ca	6.5E+00 ca	1.5E-02 ca	1.5E-01 ca		
	8.0E-02 i		8.0E-02 r	1	0.10	91-58-7	**beta-Chloronaphthalene**	3.7E+03 nc	2.4E+04 nc	2.9E+02 nc	4.9E+02 nc		
2.5E-02 h		2.5E-02 r	r	0	0.10	88-73-3	o-Chloronitrobenzene	1.8E+01 ca	1.2E+02 ca	2.7E-01 ca	2.7E+00 ca		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
1.8E-02 h		1.8E-02 r	r	0	0.10	100-00-5	p-Chloronitrobenzene	2.5E+01 ca	1.7E+02 ca	3.7E-01 ca	3.7E+00 ca		
	5.0E-03 i		5.0E-03 r	1	0.10	95-57-8	2-Chlorophenol	5.9E+01 nc	2.4E+02 nc	1.8E+01 nc	3.8E+01 nc	4.0E+00	2.0E-01
	2.9E-02 r		2.9E-02 h	1	0.10	SU 75-29-6	2-Chloropropane	1.6E+02 nc	5.9E+02 nc	1.0E+02 nc	1.7E+02 nc		
1.1E-02 h	1.5E-02 i	1.1E-02 r	1.5E-02 r	0	0.10	1897-45-6	Chlorothalonil	4.0E+01 ca*	2.7E+02 ca*	6.1E-01 ca*	6.1E+00 ca*		
	2.0E-02 i		2.0E-02 r	1	0.10	SU 95-49-8	o-Chlorotoluene	1.5E+02 nc	5.6E+02 nc	7.3E+01 nc	1.2E+02 nc		
	2.0E-01 i		2.0E-01 r	0	0.10	101-21-3	Chlorpropham	1.1E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
	3.0E-03 i		3.0E-03 r	0	0.10	2921-88-2	Chlorpyrifos	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
	1.0E-02 h		1.0E-02 r	0	0.10	5598-13-0	Chlorpyrifos-methyl	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	64902-72-3	Chlorsulfuron	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	8.0E-04 h		8.0E-04 r	0	0.10	60238-56-4	Chlorthiophos	4.4E+01 nc	8.6E+02 nc	2.9E+00 nc	2.9E+01 nc		
		4.2E+01 i		0	0.01	n/a	Total Chromium (1/6 ratio Cr VI/Cr III)	2.1E+02 ca	4.5E+02 ca	1.6E-04 ca		3.8E+01	2.0E+00
	5.0E-03 i	2.9E+02 i		0	0.01	7440-47-3	Chromium VI	3.0E+01 ca*	6.4E+01 ca	2.3E-05 ca	1.8E+02 nc	3.8E+01	2.0E+00
							"CAL-Modified PRG" (PEA, 1994)	**2.0E-01**			**1.6E-01**		
	6.0E-02 x		5.7E-06 x	0	0.01	7440-48-4	Cobalt	3.3E+03 nc	2.9E+04 nc	2.1E-02 nc	2.2E+03 nc		
		2.2E+00 i		0	0.01	8007-45-2	Coke Oven Emissions			3.1E-03 ca			
	3.7E-02 h			0	0.01	7440-50-8	Copper and compounds	2.8E+03 nc	7.0E+04 nc		1.4E+03 nc		
1.9E+00 h	1.0E-02 x	1.9E+00 x	1.0E-02 r	1	0.10	SU 123-73-9	Crotonaldehyde	5.3E-03 ca	1.1E-02 ca	3.5E-03 ca	5.9E-03 ca		
	1.0E-01 i		**1.1E-01 i**	1	0.10	98-82-8	**Cumene (isopropylbenzene)**	1.6E+02 nc	5.2E+02 nc	4.0E+02 nc	6.6E+02 nc		
8.4E-01 h	2.0E-03 h	8.4E-01 r	2.0E-03 r	0	0.10	21725-46-2	Cyanazine	5.3E-01 ca	3.6E+00 ca	8.0E-03 ca	8.0E-02 ca		
						n/a	Cyanides						
	1.0E-01 h			0	0.10	542-62-1	Barium cyanide	5.5E+03 nc	1.0E+05 max		3.7E+03 nc		
	4.0E-02 i			0	0.10	592-01-8	Calcium cyanide	2.2E+03 nc	4.3E+04 nc		1.5E+03 nc		
	5.0E-03 i			0	0.10	544-92-3	Copper cyanide	2.7E+02 nc	5.3E+03 nc		1.8E+02 nc		
	4.0E-02 i			0	0.10	460-19-5	Cyanogen	2.2E+03 nc	4.3E+04 nc		1.5E+03 nc		
	9.0E-02 i			0	0.10	506-68-3	Cyanogen bromide	4.9E+03 nc	1.0E+05 max		3.3E+03 nc		
	5.0E-02 i			0	0.10	506-77-4	Cyanogen chloride	2.7E+03 nc	5.3E+04 nc		1.8E+03 nc		
	2.0E-02 i			0	0.10	57-12-5	Free cyanide	1.1E+03 nc	2.1E+04 nc		7.3E+02 nc	4.0E+01	2.0E+00
	2.0E-02 i		8.6E-04 i	1	0.10	74-90-8	Hydrogen cyanide	1.1E+01 nc	3.5E+01 nc	3.1E+00 nc	6.2E+00 nc		
	5.0E-02 i			0	0.10	151-50-8	Potassium cyanide	2.7E+03 nc	5.3E+04 nc		1.8E+03 nc		
	2.0E-01 i			0	0.10	506-61-6	Potassium silver cyanide	1.1E+04 nc	1.0E+05 max		7.3E+03 nc		
	1.0E-01 i			0	0.10	506-64-9	Silver cyanide	5.5E+03 nc	1.1E+05 nc		3.7E+03 nc		
	4.0E-02 i			0	0.10	143-33-9	Sodium cyanide	2.2E+03 nc	4.3E+04 nc		1.5E+03 nc		
	5.0E-02 i			0	0.10	557-21-1	Zinc cyanide	2.7E+03 nc	5.3E+04 nc		1.8E+03 nc		
	5.0E+00 i		5.0E+00 r	0	0.10	108-94-1	Cyclohexanone	1.0E+05 max	1.0E+05 max	1.8E+04 nc	1.8E+05 nc		
	2.0E-01 i		2.0E-01 r	0	0.10	108-91-8	Cyclohexylamine	1.1E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	68085-85-8	Cyhalothrin/Karate	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	52315-07-8	Cypermethrin	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	7.5E-03 i		7.5E-03 r	0	0.10	66215-27-8	Cyromazine	4.1E+02 nc	8.0E+03 nc	2.7E+01 nc	2.7E+02 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	1861-32-1	Dacthal	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	3.0E-02 i		3.0E-02 r	0	0.10	75-99-0	Dalapon	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	39515-41-8	Danitol	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
2.4E-01 i		2.4E-01 r		0	0.03	72-54-8	DDD	2.4E+00 ca	1.9E+01 ca	2.8E-02 ca	2.8E-01 ca	1.6E+01	8.0E-01

Key i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where nc < 100X ca) **(where nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFI 1/(mg/kg-d)	RfDI (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
3.4E-01 i		3.4E-01 r		0	0.03	72-55-9	DDE	1.7E+00 ca	1.3E+01 ca	2.0E-02 ca	2.0E-01 ca	5.4E+01	3.0E+00
3.4E-01 i	5.0E-04 i	3.4E-01 i	5.0E-04 r	0	0.03	50-29-3	DDT	1.7E+00 ca*	1.3E+01 ca*	2.0E-02 ca*	2.0E-01 ca*	3.2E+01	2.0E+00
	1.0E-02 i		1.0E-02 r	0	0.10	1163-19-5	Decabromodiphenyl ether	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	4.0E-05 i		4.0E-05 r	0	0.10	8065-48-3	Demeton	2.2E+00 nc	4.3E+01 nc	1.5E-01 nc	1.5E+00 nc		
6.1E-02 h		6.1E-02 r		0	0.10	2303-16-4	Diallate	7.3E+00 ca	4.9E+01 ca	1.1E-01 ca	1.1E+00 ca		
	9.0E-04 h		9.0E-04 r	0	0.10	333-41-5	Diazinon	4.9E+01 nc	9.6E+02 nc	3.3E+00 nc	3.3E+01 nc		
	4.0E-03 x		4.0E-03 r	1	0.10	132-64-9	**Dibenzofuran**	2.1E+02 nc	3.2E+03 nc	1.5E+01 nc	2.4E+01 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	106-37-6	1,4-Dibromobenzene	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
8.4E-02 i	2.0E-02 i	8.4E-02 r	2.0E-02 r	0	0.10	124-48-1	Dibromochloromethane	5.3E+00 ca	3.6E+01 ca	8.0E-02 ca	1.0E+00 ca	4.0E-01	2.0E-02
1.4E+00 h	5.7E-05 r	2.4E-03 h	5.7E-05 i	0	0.10	96-12-8	1,2-Dibromo-3-chloropropane	3.2E-01 ca**	2.1E+00 ca*	2.1E-01 nc	4.8E-02 ca*		
							"CAL-Modified PRG" (PEA, 1994)	**6.0E-02**		**9.6E-04**	**4.7E-03**		
8.5E+01 i	5.7E-05 r	7.7E-01 i	5.7E-05 h	1	0.10	106-93-4	1,2-Dibromoethane	4.9E-03 ca	2.9E-02 ca*	8.7E-03 ca*	7.6E-04 ca		
	1.0E-01 i		1.0E-01 r	0	0.10	84-74-2	Dibutyl phthalate	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc	2.3E+03	2.7E+02
	3.0E-02 i		3.0E-02 r	0	0.10	1918-00-9	Dicamba	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	9.0E-02 i		5.7E-02 h	1	0.10	95-50-1	1,2-Dichlorobenzene	3.7E+02 sat	3.7E+02 sat	2.1E+02 nc	3.7E+02 nc	1.7E+01	9.0E-01
	3.0E-02 n		2.3E-03 n	1	0.10	541-73-1	**1,3-Dichlorobenzene**	4.1E+01 nc	1.4E+02 nc	8.4E+00 nc	1.7E+01 nc		
2.4E-02 h	2.0E-01 n	2.4E-02 r	2.3E-01 i	1	0.10	106-46-7	1,4-Dichlorobenzene	3.0E+00 ca	7.3E+00 ca	2.8E-01 ca	4.7E-01 ca	2.0E+00	1.0E-01
4.5E-01 i		4.5E-01 r		0	0.10	91-94-1	3,3-Dichlorobenzidine	9.9E-01 ca	6.7E+00 ca	1.5E-02 ca	1.5E-01 ca	7.0E-03	3.0E-04
9.3E+00 r		9.3E+00 h		1	0.10	764-41-0	1,4-Dichloro-2-butene	7.5E-03 ca	1.8E-02 ca	7.2E-04 ca	1.2E-03 ca		
	2.0E-01 i		5.7E-02 h	1	0.10	75-71-8	Dichlorodifluoromethane	9.4E+01 nc	3.1E+02 nc	2.1E+02 nc	3.9E+02 nc		
	1.0E-01 h		1.4E-01 h	1	0.10	75-34-3	1,1-Dichloroethane	5.7E+02 nc	2.0E+03 nc	5.2E+02 nc	8.1E+02 nc	2.3E+01	1.0E+00
9.1E-02 i	2.9E-03 r	9.1E-02 i	2.9E-03 x	1	0.10	107-06-2	**1,2-Dichloroethane (EDC)**	3.4E-01 ca*	7.6E-01 ca*	7.4E-02 ca	1.2E-01 ca	2.0E-02	1.0E-03
6.0E-01 i	9.0E-03 i	1.8E-01 i	9.0E-03 r	1	0.10	75-35-4	1,1-Dichloroethylene	5.2E-02 ca	1.2E-01 ca	3.8E-02 ca	4.6E-02 ca	6.0E-02	3.0E-03
	1.0E-02 h		1.0E-02 r	1	0.10	156-59-2	1,2-Dichloroethylene (cis)	4.2E+01 nc	1.5E+02 nc	3.7E+01 nc	6.1E+01 nc	4.0E-01	2.0E-02
	2.0E-02 i		2.0E-02 r	1	0.10	156-60-5	1,2-Dichloroethylene (trans)	6.2E+01 nc	2.1E+02 nc	7.3E+01 nc	1.2E+02 nc	7.0E-01	3.0E-02
	3.0E-03 i		3.0E-03 r	0	0.10	120-83-2	2,4-Dichlorophenol	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc	1.0E+00	5.0E-02
	8.0E-03 i		8.0E-03 r	0	0.10	94-82-6	4-(2,4-Dichlorophenoxy)butyric Acid (2,4-DB)	4.4E+02 nc	8.6E+03 nc	2.9E+01 nc	2.9E+02 nc		
	1.0E-02 i		1.0E-02 r	0	0.05	94-75-7	2,4-Dichlorophenoxyacetic Acid (2,4-D)	6.4E+02 nc	1.4E+04 nc	3.7E+01 nc	3.7E+02 nc		
6.8E-02 h	1.1E-03 r	6.8E-02 r	1.1E-03 i	1	0.10	78-87-5	1,2-Dichloropropane	3.4E-01 ca*	7.6E-01 ca*	9.9E-02 ca*	1.6E-01 ca*	3.0E-02	1.0E-03
1.8E-01 h	3.0E-04 i	1.3E-01 h	5.7E-03 i	1	0.10	542-75-6	1,3-Dichloropropene	8.1E-02 ca*	1.8E-01 ca	5.2E-02 ca	8.1E-02 ca	4.0E-03	2.0E-04
	3.0E-03 i		3.0E-03 r	0	0.10	616-23-9	2,3-Dichloropropanol	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
2.9E-01 i	5.0E-04 i	2.9E-01 r	1.4E-04 i	0	0.10	62-73-7	Dichlorvos	1.5E+00 ca*	1.0E+01 ca*	2.3E-02 ca*	2.3E-01 ca*		
4.4E-01 x		4.4E-01 r		0	0.10	115-32-2	Dicofol	1.0E+00 ca	6.8E+00 ca	1.5E-02 ca	1.5E-01 ca		
	3.0E-02 h		5.7E-05 h	1	0.10	77-73-6	**Dicyclopentadiene**	5.4E-01 nc	1.8E+00 nc	2.1E-01 nc	4.2E-01 nc		
1.6E+01 i	5.0E-05 i	1.6E+01 i	5.0E-05 r	0	0.10	60-57-1	Dieldrin	2.8E-02 ca*	1.9E-01 ca	4.2E-04 ca	4.2E-03 ca	4.0E-03	2.0E-04
	5.7E-03 h		5.7E-03 x	0	0.10	112-34-5	Diethylene glycol, monobutyl ether	3.1E+02 nc	6.1E+03 nc	2.1E+01 nc	2.1E+02 nc		
	2.0E+00 h		2.0E+00 r	0	0.10	111-90-0	Diethylene glycol, monoethyl ether	1.0E+05 max	1.0E+05 max	7.3E+03 nc	7.3E+04 nc		
	1.1E-02 h		1.1E-02 r	0	0.10	617-84-5	Diethylformamide	6.0E+02 nc	1.2E+04 nc	4.0E+01 nc	4.0E+02 nc		
1.2E-03 i	6.0E-01 i	1.2E-03 r	6.0E-01 r	0	0.10	103-23-1	Di(2-ethylhexyl)adipate	3.7E+02 ca	2.5E+03 ca	5.6E+00 ca	5.6E+01 ca		
	8.0E-01 i		8.0E-01 r	0	0.10	84-66-2	Diethyl phthalate	4.4E+04 nc	1.0E+05 max	2.9E+03 nc	2.9E+04 nc		
4.7E+03 h		4.7E+03 r		0	0.10	56-53-1	Diethylstilbestrol	9.4E-05 ca	6.4E-04 ca	1.4E-06 ca	1.4E-05 ca		
	8.0E-02 i		8.0E-02 r	0	0.10	43222-48-6	Difenzoquat (Avenge)	4.4E+03 nc	8.6E+04 nc	2.9E+02 nc	2.9E+03 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	2.0E-02 i		2.0E-02 r	0	0.10	35367-38-5	Diflubenzuron	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.1E+01 r		1.1E+01 i	1	0.10	75-37-6	1,1-Difluoroethane			4.2E+04 nc	6.9E+04 nc		
	8.0E-02 i		8.0E-02 r	0	0.10	1445-75-6	Diisopropyl methylphosphonate	4.4E+03 nc	8.6E+04 nc	2.9E+02 nc	2.9E+03 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	55290-64-7	Dimethipin	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	2.0E-04 i		2.0E-04 r	0	0.10	60-51-5	Dimethoate	1.1E+01 nc	2.1E+02 nc	7.3E-01 nc	7.3E+00 nc		
1.4E-02 h		1.4E-02 r		0	0.10	119-90-4	3,3'-Dimethoxybenzidine	3.2E+01 ca	2.1E+02 ca	4.8E-01 ca	4.8E+00 ca		
	5.7E-06 r		5.7E-06 x	1	0.10	124-40-3	Dimethylamine	6.3E-02 nc	2.5E-01 nc	2.1E-02 nc	3.5E-02 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	121-69-7	N-N-Dimethylaniline	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
7.5E-01 h		7.5E-01 r		0	0.10	95-68-1	2,4-Dimethylaniline	5.9E-01 ca	4.0E+00 ca	9.0E-03 ca	9.0E-02 ca		
5.8E-01 h		5.8E-01 r		0	0.10	21436-96-4	2,4-Dimethylaniline hydrochloride	7.7E-01 ca	5.2E+00 ca	1.2E-02 ca	1.2E-01 ca		
9.2E+00 h		9.2E+00 r		0	0.10	119-93-7	3,3'-Dimethylbenzidine	4.8E-02 ca	3.3E-01 ca	7.3E-04 ca	7.3E-03 ca		
2.6E+00 x		3.5E+00 x		0	0.10	57-14-7	1,1-Dimethylhydrazine	1.7E-01 ca	1.2E+00 ca	1.9E-03 ca	2.6E-02 ca		
3.7E+01 x		3.7E+01 x		0	0.10	540-73-8	1,2-Dimethylhydrazine	1.2E-02 ca	8.1E-02 ca	1.8E-04 ca	1.8E-03 ca		
	1.0E-01 h		8.6E-03 i	0	0.10	68-12-2	N,N-Dimethylformamide	5.4E+03 nc	1.1E+05 nc	3.1E+01 nc	3.7E+03 nc		
	1.0E-03 n		**1.0E-03 r**	0	0.10	122-09-8	**Dimethylphenethylamine**	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	105-67-9	2,4-Dimethylphenol	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc	9.0E+00	4.0E-01
	6.0E-04 i		6.0E-04 r	0	0.10	576-26-1	2,6-Dimethylphenol	3.3E+01 nc	6.4E+02 nc	2.2E+00 nc	2.2E+01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	95-65-8	3,4-Dimethylphenol	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	1.0E+01 h		1.0E+01 r	0	0.10	131-11-3	Dimethyl phthalate	1.0E+05 max	1.0E+05 max	3.7E+04 nc	3.7E+05 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	120-61-6	Dimethyl terephthalate	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	131-89-5	4,6-Dinitro-o-cyclohexyl phenol	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	4.0E-04 h		4.0E-04 r	0	0.10	528-29-0	1,2-Dinitrobenzene	2.2E+01 nc	4.3E+02 nc	1.5E+00 nc	1.5E+01 nc		
	1.0E-04 i		1.0E-04 r	0	0.10	99-65-0	1,3-Dinitrobenzene	5.5E+00 nc	1.1E+02 nc	3.7E-01 nc	3.7E+00 nc		
	4.0E-04 h		4.0E-04 r	0	0.10	100-25-4	1,4-Dinitrobenzene	2.2E+01 nc	4.3E+02 nc	1.5E+00 nc	1.5E+01 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	51-28-5	2,4-Dinitrophenol	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc	3.0E-01	1.0E-02
6.8E-01 i		6.8E-01 r		0	0.10	25321-14-6	Dinitrotoluene mixture	6.5E-01 ca	4.4E+00 ca	9.9E-03 ca	9.9E-02 ca	8.0E-04	4.0E-05
	2.0E-03 i		2.0E-03 r	0	0.10	121-14-2	2,4-Dinitrotoluene (also see Dinitrotoluene mixture)	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc	8.0E-04	4.0E-05
	1.0E-03 h		1.0E-03 r	0	0.10	606-20-2	2,6-Dinitrotoluene (also see Dinitrotoluene mixture)	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc	7.0E-04	3.0E-05
	1.0E-03 i		1.0E-03 r	0	0.10	88-85-7	Dinoseb	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	2.0E-02 h		2.0E-02 r	0	0.10	117-84-0	di-n-Octyl phthalate	1.1E+03 nc	1.0E+04 sat	7.3E+01 nc	7.3E+02 nc	1.0E+04	1.0E+04
1.1E-02 i		**1.1E-02 r**		0	0.10	123-91-1	**1,4-Dioxane**	4.0E+01 ca	2.7E+02 ca	6.1E-01 ca	6.1E+00 ca		
1.5E+05 h		1.5E+05 h		0	0.03	1746-01-6	Dioxin (2,3,7,8-TCDD)	3.8E-06 ca	3.0E-05 ca	4.5E-08 ca	4.5E-07 ca		
	3.0E-02 i		3.0E-02 r	0	0.10	957-51-7	Diphenamid	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	122-39-4	Diphenylamine	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
8.0E-01 i		7.7E-01 i		0	0.10	122-66-7	1,2-Diphenylhydrazine	5.6E-01 ca	3.7E+00 ca	8.7E-03 ca	8.4E-02 ca		
	9.0E-03 n		**9.0E-03 r**	0	0.10	127-63-9	**Diphenyl sulfone**	4.9E+02 nc	9.6E+03 nc	3.3E+01 nc	3.3E+02 nc		
	2.2E-03 i		2.2E-03 r	0	0.10	85-00-7	Diquat	1.2E+02 nc	2.4E+03 nc	8.0E+00 nc	8.0E+01 nc		
8.6E+00 h		8.6E+00 r		0	0.10	1937-37-7	Direct black 38	5.2E-02 ca	3.5E-01 ca	7.8E-04 ca	7.8E-03 ca		
8.1E+00 h		8.1E+00 r		0	0.10	2602-46-2	Direct blue 6	5.5E-02 ca	3.7E-01 ca	8.3E-04 ca	8.3E-03 ca		
9.3E+00 h		9.3E+00 r		0	0.10	16071-86-6	Direct brown 95	4.8E-02 ca	3.2E-01 ca	7.2E-04 ca	7.2E-03 ca		
	4.0E-05 i		4.0E-05 r	0	0.10	298-04-4	Disulfoton	2.2E+00 nc	4.3E+01 nc	1.5E-01 nc	1.5E+00 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	505-29-3	1,4-Dithiane	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		

Key: i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where nc < 100X ca) **(where nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	2.0E-03 i		2.0E-03 r	0	0.10	330-54-1	Diuron	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	4.0E-03 i		4.0E-03 r	0	0.10	2439-10-3	Dodine	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc		
	6.0E-03 i		6.0E-03 r	0	0.10	115-29-7	**Endosulfan**	3.3E+02 nc	6.4E+03 nc	2.2E+01 nc	2.2E+02 nc	1.8E+01	9.0E-01
	2.0E-02 i		2.0E-02 r	0	0.10	145-73-3	Endothall	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	72-20-8	Endrin	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc	1.0E+00	5.0E-02
9.9E-03 i	2.0E-03 h	4.2E-03 i	2.9E-04 i	1	0.10	106-89-8	Epichlorohydrin	7.4E+00 nc	2.6E+01 nc	1.0E+00 nc	2.0E+00 nc		
	5.7E-03 r		5.7E-03 i	0	0.10	106-88-7	1,2-Epoxybutane	3.1E+02 nc	6.1E+03 nc	2.1E+01 nc	2.1E+02 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	759-94-4	EPTC (S-Ethyl dipropylthiocarbamate)	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	16672-87-0	Ethephon (2-chloroethyl phosphonic acid)	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	5.0E-04 i		5.0E-04 r	0	0.10	563-12-2	Ethion	2.7E+01 nc	5.3E+02 nc	1.8E+00 nc	1.8E+01 nc		
	4.0E-01 h		5.7E-02 i	0	0.10	110-80-5	2-Ethoxyethanol	2.2E+04 nc	1.0E+05 max	2.1E+02 nc	1.5E+04 nc		
	3.0E-01 h		3.0E-01 r	0	0.10	111-15-9	2-Ethoxyethanol acetate	1.6E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
	9.0E-01 i		9.0E-01 r	1	0.10	141-78-6	**Ethyl acetate**	1.7E+04 nc	7.7E+04 sat	3.3E+03 nc	5.5E+03 nc		
4.8E-02 h		4.8E-02 r		1	0.10	SU 140-88-5	Ethyl acrylate	2.1E-01 ca	4.5E-01 ca	1.4E-01 ca	2.3E-01 ca		
	1.0E-01 i		2.9E-01 i	1	0.10	100-41-4	Ethylbenzene	2.3E+02 sat	2.3E+02 sat	1.1E+03 nc	1.3E+03 nc	1.3E+01	7.0E-01
	4.0E-01 n		2.9E+00 i	1	0.10	75-00-3	**Ethyl chloride**	1.6E+03 sat	1.6E+03 sat	1.0E+04 nc	8.6E+03 nc		
	3.0E-01 h		3.0E-01 r	0	0.10	109-78-4	Ethylene cyanohydrin	1.6E+04 nc	1.0E+05 max	1.1E+03 nc	1.1E+04 nc		
	2.0E-02 h		2.0E-02 r	0	0.10	107-15-3	Ethylene diamine	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	2.0E+00 i		2.0E+00 r	0	0.10	107-21-1	Ethylene glycol	1.0E+05 max	1.0E+05 max	7.3E+03 nc	7.3E+04 nc		
	5.7E-03 r		5.7E-03 h	0	0.10	111-76-2	Ethylene glycol, monobutyl ether	3.1E+02 nc	6.1E+03 nc	2.1E+01 nc	2.1E+02 nc		
1.0E+00 h		3.5E-01 h		1	0.10	75-21-8	Ethylene oxide	1.3E-01 ca	3.4E-01 ca	1.9E-02 ca	2.4E-02 ca		
1.1E-01 h	8.0E-05 i	1.1E-01 r	8.0E-05 r	0	0.10	96-45-7	**Ethylene thiourea (ETU)**	4.0E+00 ca**	2.7E+01 ca**	6.1E-02 ca**	6.1E-01 ca**		
	2.0E-01 i		2.0E-01 r	1	0.10	SU 60-29-7	Ethyl ether	1.8E+03 sat	1.8E+03 sat	7.3E+02 nc	1.2E+03 nc		
	9.0E-02 h		9.0E-02 r	1	0.10	SU 97-63-2	Ethyl methacrylate	1.4E+02 sat	1.4E+02 sat	3.3E+02 nc	5.5E+02 nc		
	1.0E-05 i		1.0E-05 r	0	0.10	2104-64-5	Ethyl p-nitrophenyl phenylphosphorothioate	5.5E-01 nc	1.1E+01 nc	3.7E-02 nc	3.7E-01 nc		
	3.0E+00 i		3.0E+00 r	0	0.10	84-72-0	Ethylphthalyl ethyl glycolate	1.0E+05 max	1.0E+05 max	1.1E+04 nc	1.1E+05 nc		
	8.0E-03 i		8.0E-03 r	0	0.10	101200-48-	Express	4.4E+02 nc	8.6E+03 nc	2.9E+01 nc	2.9E+02 nc		
	2.5E-04 i		2.5E-04 r	0	0.10	22224-92-6	Fenamiphos	1.4E+01 nc	2.7E+02 nc	9.1E-01 nc	9.1E+00 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	2164-17-2	Fluometuron	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	6.0E-02 i			0	0.10	16984-48-8	Flouride (soluble)	3.3E+03 nc	6.4E+04 nc		2.2E+03 nc		
	8.0E-02 i		8.0E-02 r	0	0.10	59756-60-4	Fluoridone	4.4E+03 nc	8.6E+04 nc	2.9E+02 nc	2.9E+03 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	56425-91-3	Flurprimidol	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	6.0E-02 i		6.0E-02 r	0	0.10	66332-96-5	Flutolanil	3.3E+03 nc	6.4E+04 nc	2.2E+02 nc	2.2E+03 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	69409-94-5	Fluvalinate	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
3.5E-03 i	1.0E-01 i	3.5E-03 r	1.0E-01 r	0	0.10	133-07-3	Folpet	1.3E+02 ca*	8.6E+02 ca	1.9E+00 ca	1.9E+01 ca		
1.9E-01 i		1.9E-01 r		0	0.10	72178-02-0	Fomesafen	2.3E+00 ca	1.6E+01 ca	3.5E-02 ca	3.5E-01 ca		
	2.0E-03 i		2.0E-03 r	0	0.10	944-22-9	Fonofos	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	1.5E-01 i	4.6E-02 i		0	0.10	50-00-0	Formaldehyde	8.2E+03 nc	1.0E+05 nc	1.5E-01 ca	5.5E+03 nc		
	2.0E+00 h		2.0E+00 r	0	0.10	64-18-6	Formic Acid	1.0E+05 max	1.0E+05 max	7.3E+03 nc	7.3E+04 nc		
	3.0E+00 i		3.0E+00 r	0	0.10	39148-24-8	Fosetyl-al	1.0E+05 max	1.0E+05 max	1.1E+04 nc	1.1E+05 nc		
	1.0E-03 i		1.0E-03 r	1	0.10	110-00-9	**Furan**	2.5E+00 nc	8.5E+00 nc	3.7E+00 nc	6.1E+00 nc		
3.8E+00 h		3.8E+00 r		0	0.10	67-45-8	Furazolidone	1.2E-01 ca	7.9E-01 ca	1.8E-03 ca	1.8E-02 ca		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFI 1/(mg/kg-d)	RfDI (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	3.0E-03 i		1.4E-02 h	0	0.10	98-01-1	Furfural	1.6E+02 nc	3.2E+03 nc	5.2E+01 nc	1.1E+02 nc		
5.0E+01 h		5.0E+01 r		0	0.10	531-82-8	Furium	8.9E-03 ca	6.0E-02 ca	1.3E-04 ca	1.3E-03 ca		
3.0E-02 i		3.0E-02 r		0	0.10	60568-05-0	Furmecyclox	1.5E+01 ca	1.0E+02 ca	2.2E-01 ca	2.2E+00 ca		
	4.0E-04 i		4.0E-04 r	0	0.10	77182-82-2	Glufosinate-ammonium	2.2E+01 nc	4.3E+02 nc	1.5E+00 nc	1.5E+01 nc		
	4.0E-04 i		2.9E-04 h	0	0.10	765-34-4	Glycidaldehyde	2.2E+01 nc	4.3E+02 nc	1.0E+00 nc	1.5E+01 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	1071-83-6	Glyphosate	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	5.0E-05 i		5.0E-05 r	0	0.10	69806-40-2	Haloxyfop-methyl	2.7E+00 nc	5.3E+01 nc	1.8E-01 nc	1.8E+00 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	79277-27-3	Harmony	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
4.5E+00 i	5.0E-04 i	4.6E+00 i	5.0E-04 r	0	0.10	76-44-8	Heptachlor	9.9E-02 ca	6.7E-01 ca	1.5E-03 ca	1.5E-02 ca	2.3E+01	1.0E+00
9.1E+00 i	1.3E-05 i	9.1E+00 i	1.3E-05 r	0	0.10	1024-57-3	Heptachlor epoxide	4.9E-02 ca*	3.3E-01 ca*	7.4E-04 ca*	7.4E-03 ca*	7.0E-01	3.0E-02
	2.0E-03 i		2.0E-03 r	0	0.10	87-82-1	Hexabromobenzene	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
1.6E+00 i	8.0E-04 i	1.6E+00 i	8.0E-04 r	0	0.10	118-74-1	Hexachlorobenzene	2.8E-01 ca	1.9E+00 ca	4.2E-03 ca	4.2E-02 ca	2.0E+00	1.0E-01
7.8E-02 i	2.0E-04 h	7.7E-02 i	2.0E-04 r	0	0.10	87-68-3	Hexachlorobutadiene	5.7E+00 ca**	3.8E+01 ca**	8.7E-02 ca*	8.6E-01 ca*	2.0E+00	1.0E-01
6.3E+00 i		6.3E+00 i		0	0.04	319-84-6	HCH (alpha)	8.6E-02 ca	6.7E-01 ca	1.1E-03 ca	1.1E-02 ca	5.0E-04	3.0E-05
1.8E+00 i		1.8E+00 i		0	0.04	319-85-7	HCH (beta)	3.0E-01 ca	2.3E+00 ca	3.7E-03 ca	3.7E-02 ca	3.0E-03	1.0E-04
1.3E+00 h	3.0E-04 i	1.3E+00 r	3.0E-04 r	0	0.04	58-89-9	HCH (gamma) Lindane	4.2E-01 ca*	3.2E+00 ca	5.2E-03 ca	5.2E-02 ca	9.0E-03	5.0E-04
1.8E+00 i		1.8E+00 i		0	0.04	608-73-1	HCH-technical	3.0E-01 ca	2.3E+00 ca	3.8E-03 ca	3.7E-02 ca	3.0E-03	1.0E-04
	7.0E-03 i		2.0E-05 h	0	0.10	77-47-4	Hexachlorocyclopentadiene	3.8E+02 nc	7.1E+03 nc	7.3E-02 nc	2.6E+02 nc	4.0E+02	2.0E+01
6.2E+03 i		4.6E+03 i		0	0.10	19408-74-3	Hexachlorodibenzo-p-dioxin mixture (HxCDD)	7.2E-05 ca	4.8E-04 ca	1.5E-06 ca	1.1E-05 ca		
1.4E-02 i	1.0E-03 i	1.4E-02 i	1.0E-03 r	0	0.10	67-72-1	Hexachloroethane	3.2E+01 ca**	2.1E+02 ca**	4.8E-01 ca**	4.8E+00 ca**	5.0E-01	2.0E-02
	3.0E-04 i		3.0E-04 r	0	0.10	70-30-4	Hexachlorophene	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
1.1E-01 i	3.0E-03 i	1.1E-01 r	3.0E-03 r	0	0.10	121-82-4	Hexahydro-1,3,5-trinitro-1,3,5-triazine	4.0E+00 ca*	2.7E+01 ca	6.1E-02 ca	6.1E-01 ca		
	2.9E-06 r		2.9E-06 i	0	0.10	822-06-0	1,6-Hexamethylene diisocyanate			1.0E-02 nc	1.0E-01 nc		
	6.0E-02 h		5.7E-02 i	1	0.10	110-54-3	n-Hexane	1.1E+02 sat	1.1E+02 sat	2.1E+02 nc	3.5E+02 nc		
	3.3E-02 i		3.3E-02 r	0	0.10	51235-04-2	Hexazinone	1.8E+03 nc	3.5E+04 nc	1.2E+02 nc	1.2E+03 nc		
3.0E+00 i		1.7E+01 i		0	0.10	302-01-2	Hydrazine, hydrazine sulfate	1.5E-01 ca	1.0E+00 ca	3.9E-04 ca	2.2E-02 ca		
			5.7E-03 i	0	0.10	7647-01-0	Hydrogen chloride			2.1E+01 nc			
	3.0E-03 i		2.9E-04 i	1	0.10	7783-06-4	Hydrogen sulfide			1.0E+00 nc	2.0E+00 nc		
	4.0E-02 h		4.0E-02 r	0	0.10	123-31-9	p-Hydroquinone	2.2E+03 nc	4.3E+04 nc	1.5E+02 nc	1.5E+03 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	35554-44-0	Imazalil	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	2.5E-01 i		2.5E-01 r	0	0.10	81335-37-7	Imazaquin	1.4E+04 nc	1.0E+05 max	9.1E+02 nc	9.1E+03 nc		
	4.0E-02 i		4.0E-02 r	0	0.10	36734-19-7	Iprodione	2.2E+03 nc	4.3E+04 nc	1.5E+02 nc	1.5E+03 nc		
	3.0E-01 n			0	0.01	7439-89-6	**Iron**	2.2E+04 nc	1.0E+05 max		1.1E+04 nc		
	3.0E-01 i		3.0E-01 r	1	0.10	78-83-1	**Isobutanol**	1.0E+04 nc	4.0E+04 sat	1.1E+03 nc	1.8E+03 nc		
9.5E-04 i	2.0E-01 i	9.5E-04 r	2.0E-01 r	0	0.10	78-59-1	Isophorone	4.7E+02 ca*	3.2E+03 ca*	7.1E+00 ca	7.1E+01 ca	5.0E-01	3.0E-02
	1.5E-02 i		1.5E-02 r	0	0.10	33820-53-0	Isopropalin	8.2E+02 nc	1.6E+04 nc	5.5E+01 nc	5.5E+02 nc		
	1.0E-01 i		1.1E-01 r	0	0.10	1832-54-8	Isopropyl methyl phosphonic acid	5.5E+03 nc	1.1E+05 nc	4.0E+02 nc	3.7E+03 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	82558-50-7	Isoxaben	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
1.8E+01 n		1.8E+01 r		0	0.10	143-50-0	Kepone	2.5E-02 ca	1.7E-01 ca	3.7E-04 ca	3.7E-03 ca		
	2.0E-03 i		2.0E-03 r	0	0.10	77501-63-4	Lactofen	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
PRGs Based on EPA Models, IEUBK (1994) and TRW (1996)						7439-92-1	Lead	4.0E+02 nc	1.0E+03 nc		4.0E+00 nc		
							"CAL-Modified PRG" (PEA, 1994)	**1.3E+02**					

(((

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	1.0E-07 i			0	0.10	78-00-2	Lead (tetraethyl)	5.5E-03 nc	1.1E-01 nc		3.7E-03 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	330-55-2	Linuron	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	2.0E-02 x			0	0.01	7439-93-2	Lithium	1.5E+03 nc	3.7E+04 nc		7.3E+02 nc		
	2.0E-01 i		2.0E-01 r	0	0.10	83055-99-6	Londax	1.1E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	121-75-5	Malathion	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	108-31-6	Maleic anhydride	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	5.0E-01 i		5.0E-01 r	1	0.10	123-33-1	**Maleic hydrazide**	1.6E+03 nc	5.6E+03 nc	1.8E+03 nc	3.0E+03 nc		
	2.0E-05 h		2.0E-05 r	0	0.10	109-77-3	Malononitrile	1.1E+00 nc	2.1E+01 nc	7.3E-02 nc	7.3E-01 nc		
	3.0E-02 h		3.0E-02 r	0	0.10	8018-01-7	Mancozeb	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
6.0E-02 o	5.0E-03 i	6.0E-02 r	5.0E-03 r	0	0.10	12427-38-2	**Maneb**	7.4E+00 ca*	5.0E+01 ca	1.1E-01 ca	1.1E+00 ca		
	4.7E-02 i		1.4E-05 i	0	0.01	7439-96-5	**Manganese and compounds**	3.1E+03 nc	4.5E+04 nc	5.1E-02 nc	1.7E+03 nc		
	9.0E-05 h		9.0E-05 r	0	0.10	950-10-7	Mephosfolan	4.9E+00 nc	9.6E+01 nc	3.3E-01 nc	3.3E+00 nc		
	3.0E-02 i		3.0E-02 r	0	0.10	24307-26-4	Mepiquat	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
2.9E-02 n	1.0E-01 n	2.9E-02 r	1.0E-01 r	0	0.10	149-30-4	**2-Mercaptobenzothiazole**	1.5E+01 ca	1.0E+02 ca	2.3E-01 ca	2.3E+00 ca		
	3.0E-04 i			0	0.01	7487-94-7	Mercury and compounds	2.2E+01 nc	5.6E+02 nc		1.1E+01 nc		
			8.6E-05 i	n/a	n/a	7439-97-6	Mercury (elemental)			3.1E-01 nc			
	1.0E-04 i			0	0.10	22967-92-6	Mercury (methyl)	5.5E+00 nc	1.1E+02 nc		3.7E+00 nc		
	3.0E-05 i		3.0E-05 r	0	0.10	150-50-5	Merphos	1.6E+00 nc	3.2E+01 nc	1.1E-01 nc	1.1E+00 nc		
	3.0E-05 i		3.0E-05 r	0	0.10	78-48-8	Merphos oxide	1.6E+00 nc	3.2E+01 nc	1.1E-01 nc	1.1E+00 nc		
	6.0E-02 i		6.0E-02 r	0	0.10	57837-19-1	Metalaxyl	3.3E+03 nc	6.4E+04 nc	2.2E+02 nc	2.2E+03 nc		
	1.0E-04 i		2.0E-04 h	1	0.10 SU	126-98-7	Methacrylonitrile	1.8E+00 nc	8.4E+00 nc	7.3E-01 nc	1.0E+00 nc		
	5.0E-05 i		5.0E-05 r	0	0.10	10265-92-6	Methamidophos	2.7E+00 nc	5.3E+01 nc	1.8E-01 nc	1.8E+00 nc		
	5.0E-01 i		5.0E-01 r	0	0.10	67-56-1	Methanol	2.7E+04 nc	1.0E+05 max	1.8E+03 nc	1.8E+04 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	950-37-8	Methidathion	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	2.5E-02 i		2.5E-02 r	1	0.10	16752-77-5	Methomyl	4.4E+01 nc	1.5E+02 nc	9.1E+01 nc	1.5E+02 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	72-43-5	Methoxychlor	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc	1.6E+02	8.0E+00
	1.0E-03 h		5.7E-03 i	0	0.10	109-86-4	2-Methoxyethanol	5.5E+01 nc	1.1E+03 nc	2.1E+01 nc	3.7E+01 nc		
	2.0E-03 h		2.0E-03 r	0	0.10	110-49-6	2-Methoxyethanol acetate	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
4.6E-02 h		4.6E-02 r		0	0.10	99-59-2	2-Methoxy-5-nitroaniline	9.7E+00 ca	6.5E+01 ca	1.5E-01 ca	1.5E+00 ca		
	1.0E+00 h		1.0E+00 r	1	0.10 SU	79-20-9	Methyl acetate	2.0E+04 nc	9.2E+04 nc	3.7E+03 nc	6.1E+03 nc		
	3.0E-02 h		3.0E-02 r	1	0.10 SU	96-33-3	Methyl acrylate	6.9E+01 nc	2.3E+02 nc	1.1E+02 nc	1.8E+02 nc		
2.4E-01 h		2.4E-01 r		0	0.10	95-53-4	2-Methylaniline (o-toluidine)	1.9E+00 ca	1.2E+01 ca	2.8E-02 ca	2.8E-01 ca		
1.8E-01 h		1.8E-01 r		0	0.10	636-21-5	2-Methylaniline hydrochloride	2.5E+00 ca	1.7E+01 ca	3.7E-02 ca	3.7E-01 ca		
	1.0E+00 x		1.0E+00 r	0	0.10	79-22-1	Methyl chlorocarbonate	5.5E+04 nc	1.0E+05 max	3.7E+03 nc	3.7E+04 nc		
	5.0E-04 i		5.0E-04 r	0	0.10	94-74-6	2-Methyl-4-chlorophenoxyacetic acid	2.7E+01 nc	5.3E+02 nc	1.8E+00 nc	1.8E+01 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	94-81-5	4-(2-Methyl-4-chlorophenoxy) butyric acid	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	93-65-2	2-(2-Methyl-4-chlorophenoxy) propionic acid	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	16484-77-8	2-(2-Methyl-1,4-chlorophenoxy) propionic acid	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	8.6E-01 r		8.6E-01 h	0	0.10	108-87-2	Methylcyclohexane	4.7E+04 nc	1.0E+05 max	3.1E+03 nc	3.1E+04 nc		
2.5E-01 h		2.5E-01 r		0	0.10	101-77-9	4,4'-Methylenebisbenzeneamine	1.8E+00 ca	1.2E+01 ca	2.7E-02 ca	2.7E-01 ca		
1.3E-01 h	7.0E-04 h	1.3E-01 h	7.0E-04 r	0	0.10	101-14-4	4,4'-Methylene bis(2-chloroaniline)	3.4E+00 ca*	2.3E+01 ca*	5.2E-02 ca*	5.2E-01 ca*		
4.6E-02 i		4.6E-02 r		0	0.10	101-61-1	4,4'-Methylene bis(N,N'-dimethyl)aniline	9.7E+00 ca	6.5E+01 ca	1.5E-01 ca	1.5E+00 ca		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	1.0E-02 h		1.0E-02 r	0	0.10	74-95-3	Methylene bromide	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
7.5E-03 i	6.0E-02 i	1.6E-03 i	8.6E-01 h	1	0.10	75-09-2	Methylene chloride	8.5E+00 ca	2.0E+01 ca	4.1E+00 ca	4.3E+00 ca	2.0E-02	1.0E-03
	1.7E-04 r		1.7E-04 i	0	0.10	101-68-8	**4,4'-Methylene diphenyl diisocyanate**	9.3E+00 nc	1.8E+02 nc	6.2E-01 nc	6.2E+00 nc		
	6.0E-01 i		2.9E-01 i	1	0.10	78-93-3	Methyl ethyl ketone	6.9E+03 nc	2.7E+04 nc	1.0E+03 nc	1.9E+03 nc		
1.1E+00 h		1.1E+00 r		0	0.10	60-34-4	Methyl hydrazine	4.0E-01 ca	2.7E+00 ca	6.1E-03 ca	6.1E-02 ca		
	8.0E-02 h		2.3E-02 h	1	0.10	108-10-1	**Methyl isobutyl ketone**	7.5E+02 nc	2.8E+03 nc	8.3E+01 nc	1.6E+02 nc		
	5.7E-04 r		5.7E-04 n	0	0.10	74-93-1	**Methyl Mercaptan**	3.1E+01 nc	6.1E+02 nc	2.1E+00 nc	2.1E+01 nc		
	1.4E+00 i		2.0E-01 i	1	0.10	80-62-6	**Methyl methacrylate**	2.2E+03 nc	7.3E+03 nc	7.3E+02 nc	1.4E+03 nc		
3.3E-02 h		3.3E-02 r		0	0.10	99-55-8	2-Methyl-5-nitroaniline	1.3E+01 ca	9.1E+01 ca	2.0E-01 ca	2.0E+00 ca		
	2.5E-04 i		2.5E-04 r	0	0.10	298-00-0	Methyl parathion	1.4E+01 nc	2.7E+02 nc	9.1E-01 nc	9.1E+00 nc		
	5.0E-02 x		5.0E-02 r	0	0.10	95-48-7	2-Methylphenol	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc	1.5E+01	8.0E-01
	5.0E-02 x		5.0E-02 r	0	0.10	108-39-4	3-Methylphenol	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	5.0E-03 h		5.0E-03 r	0	0.10	106-44-5	4-Methylphenol	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	2.0E-02 n		2.0E-02 r	0	0.10	993-13-5	**Methyl phosphonic acid**	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	6.0E-03 h		1.1E-02 h	1	0.10	SU 25013-15-4	Methyl styrene (mixture)	1.2E+02 nc	5.4E+02 nc	4.2E+01 nc	6.0E+01 nc		
	7.0E-02 h		7.0E-02 r	1	0.10	SU 98-83-9	Methyl styrene (alpha)	6.8E+02 sat	6.8E+02 sat	2.6E+02 nc	4.3E+02 nc		
			8.6E-01 i	1	0.10	1634-04-4	**Methyl tertbutyl ether (MTBE)**	n/a	n/a	3.1E+03 nc	2.0E+01 nc/ca		
	1.5E-01 i		1.5E-01 r	0	0.10	51218-45-2	Metolaclor (Dual)	8.2E+03 nc	1.0E+05 max	5.5E+02 nc	5.5E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	21087-64-9	Metribuzin	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
1.8E+00 h	2.0E-04 i	1.8E+00 r	2.0E-04 r	0	0.10	2385-85-5	Mirex	2.5E-01 ca*	1.7E+00 ca	3.7E-03 ca	3.7E-02 ca		
	2.0E-03 i		2.0E-03 r	0	0.10	2212-67-1	Molinate	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	5.0E-03 h			0	0.01	7439-98-7	Molybdenum	3.7E+02 nc	9.4E+03 nc		1.8E+02 nc		
	1.0E-01 h		1.0E-01 h	0	0.10	10599-90-3	Monochloramine	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	300-76-5	Naled	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	15299-99-7	Napropamide	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	2.0E-02 i			0	0.01	7440-02-0	Nickel (soluble salts)	1.5E+03 nc	3.7E+04 nc		7.3E+02 nc	1.3E+02	7.0E+00
							"CAL-Modified PRG" (PEA, 1994)	**1.5E+02**					
		8.4E-01 i		0	0.01	n/a	Nickel refinery dust			8.0E-03 ca			
		1.7E+00 i		0	0.01	12035-72-2	Nickel subsulfide		1.1E+04 ca	4.0E-03 ca			
	1.5E-03 x		1.5E-03 r	0	0.10	1929-82-4	Nitrapyrin	8.2E+01 nc	1.6E+03 nc	5.5E+00 nc	5.5E+01 nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)						14797-55-8	Nitrate				1.0E+04 nc		
	1.0E-01 x			0	0.10	10102-43-9	Nitric Oxide	5.5E+03 nc	1.1E+05 nc		3.7E+03 nc		
Tap Water PRG Based on Infant NOAEL (see IRIS)						14797-65-0	Nitrite				1.0E+03 nc		
	6.0E-05 r		5.7E-05 h	0	0.10	88-74-4	2-Nitroaniline	3.3E+00 nc	6.4E+01 nc	2.1E-01 nc	2.2E+00 nc		
				0	0.10	99-09-2	3-Nitroaniline						
				0	0.10	100-01-6	4-Nitroaniline						
	5.0E-04 i		5.7E-04 h	1	0.10	98-95-3	**Nitrobenzene**	1.6E+01 nc	1.0E+02 nc	2.1E+00 nc	3.4E+00 nc	1.0E-01	7.0E-03
	7.0E-02 h		7.0E-02 r	0	0.10	67-20-9	Nitrofurantoin	3.8E+03 nc	7.5E+04 nc	2.6E+02 nc	2.6E+03 nc		
1.5E+00 h		9.4E+00 h		0	0.10	59-87-0	Nitrofurazone	3.0E-01 ca	2.0E+00 ca	7.2E-04 ca	4.5E-02 ca		
	1.0E+00 x			0	0.10	101102-44-	Nitrogen dioxide						
	1.0E-01 i		1.0E-01 r	0	0.10	556-88-7	Nitroguanidine	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc		
	6.2E-02 o		6.2E-02 r	0	0.10	100-02-7	4-Nitrophenol	3.4E+03 nc	6.6E+04 nc	2.3E+02 nc	2.3E+03 nc		

(((

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFI 1/(mg/kg-d)	RfDI (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
9.4E+00 r	5.7E-03 r	9.4E+00 h	5.7E-03 i	1	0.10	79-46-9	2-Nitropropane			7.2E-04 ca	3.5E+01 ca		
5.4E+00 i		5.6E+00 i		1	0.10	924-16-3	**N-Nitrosodi-n-butylamine**	2.2E-02 ca	5.8E-02 ca	1.2E-03 ca	2.0E-03 ca		
2.8E+00 i		2.8E+00 r		0	0.10	1116-54-7	N-Nitrosodiethanolamine	1.6E-01 ca	1.1E+00 ca	2.4E-03 ca	2.4E-02 ca		
1.5E+02 i		1.5E+02 i		0	0.10	55-18-5	N-Nitrosodiethylamine	3.0E-03 ca	2.0E-02 ca	4.5E-05 ca	4.5E-04 ca		
5.1E+01 i		4.9E+01 i		0	0.10	62-75-9	N-Nitrosodimethylamine	8.7E-03 ca	5.9E-02 ca	1.4E-04 ca	1.3E-03 ca		
4.9E-03 i		4.9E-03 r		0	0.10	86-30-6	N-Nitrosodiphenylamine	9.1E+01 ca	6.1E+02 ca	1.4E+00 ca	1.4E+01 ca	1.0E+00	6.0E-02
7.0E+00 i		7.0E+00 r		0	0.10	621-64-7	N-Nitroso di-n-propylamine	6.3E-02 ca	4.3E-01 ca	9.6E-04 ca	9.6E-03 ca	5.0E-05	2.0E-06
2.2E+01 i		2.2E+01 r		0	0.10	10595-95-6	N-Nitroso-N-methylethylamine	2.0E-02 ca	1.4E-01 ca	3.1E-04 ca	3.1E-03 ca		
2.1E+00 i		2.1E+00 i		0	0.10	930-55-2	N-Nitrosopyrrolidine	2.1E-01 ca	1.4E+00 ca	3.1E-03 ca	3.2E-02 ca		
	1.0E-02 h		1.0E-02 r	0	0.10	99-08-1	m-Nitrotoluene	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	1.0E-02 h		1.0E-02 r	0	0.10	99-08-1	o-Nitrotoluene	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	1.0E-02 h		1.0E-02 r	0	0.10	99-99-0	p-Nitrotoluene	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	4.0E-02 i		4.0E-02 r	0	0.10	27314-13-2	Norflurazon	2.2E+03 nc	4.3E+04 nc	1.5E+02 nc	1.5E+03 nc		
	7.0E-04 i		7.0E-04 r	0	0.10	85509-19-9	NuStar	3.8E+01 nc	7.5E+02 nc	2.6E+00 nc	2.6E+01 nc		
	3.0E-03 i		3.0E-03 r	0	0.10	32536-52-0	Octabromodiphenyl ether	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	2691-41-0	Octahydro-1357-tetranitro-1357- tetrazocine (HMX)	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	2.0E-03 h		2.0E-03 r	0	0.10	152-16-9	Octamethylpyrophosphoramide	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	19044-88-3	Oryzalin	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	19666-30-9	Oxadiazon	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	23135-22-0	Oxamyl	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	3.0E-03 i		3.0E-03 r	0	0.10	42874-03-3	Oxyfluorfen	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	76738-62-0	Paclobutrazol	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	4.5E-03 i		4.5E-03 r	0	0.10	4685-14-7	Paraquat	2.5E+02 nc	4.8E+03 nc	1.6E+01 nc	1.6E+02 nc		
	6.0E-03 h		6.0E-03 r	0	0.10	56-38-2	Parathion	3.3E+02 nc	6.4E+03 nc	2.2E+01 nc	2.2E+02 nc		
	5.0E-02 h		5.0E-02 r	0	0.10	1114-71-2	Pebulate	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	4.0E-02 i		4.0E-02 r	0	0.10	40487-42-1	Pendimethalin	2.2E+03 nc	4.3E+04 nc	1.5E+02 nc	1.5E+03 nc		
2.3E-02 h		2.3E-02 r		0	0.10	87-84-3	Pentabromo-6-chloro cyclohexane	1.9E+01 ca	1.3E+02 ca	2.9E-01 ca	2.9E+00 ca		
	2.0E-03 i		2.0E-03 r	0	0.10	32534-81-9	Pentabromodiphenyl ether	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	8.0E-04 i		8.0E-04 r	0	0.10	608-93-5	Pentachlorobenzene	4.4E+01 nc	8.6E+02 nc	2.9E+00 nc	2.9E+01 nc		
2.6E-01 h	3.0E-03 i	2.6E-01 r	3.0E-03 r	0	0.10	82-68-8	Pentachloronitrobenzene	1.7E+00 ca*	1.2E+01 ca	2.6E-02 ca	2.6E-01 ca		
1.2E-01 i	3.0E-02 i	1.2E-01 r	3.0E-02 r	0	0.25	87-86-5	Pentachlorophenol	2.5E+00 ca	1.5E+01 ca	5.6E-02 ca	5.6E-01 ca	3.0E-02	1.0E-03
	5.0E-04 n			0	0.01	7601-90-3	**Perchlorate**	3.7E+01 nc	9.4E+02 nc		1.8E+01 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	52645-53-1	Permethrin	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	2.5E-01 i		2.5E-01 r	0	0.10	13684-63-4	Phenmedipham	1.4E+04 nc	1.0E+05 max	9.1E+02 nc	9.1E+03 nc		
	6.0E-01 i		6.0E-01 r	0	0.10	108-95-2	Phenol	3.3E+04 nc	1.0E+05 max	2.2E+03 nc	2.2E+04 nc	1.0E+02	5.0E+00
	2.0E-03 n		**2.0E-03 r**	0	0.10	92-84-2	**Phenothiazine**	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	6.0E-03 i		6.0E-03 r	0	0.10	108-45-2	m-Phenylenediamine	3.3E+02 nc	6.4E+03 nc	2.2E+01 nc	2.2E+02 nc		
	1.9E-01 h		1.9E-01 r	0	0.10	106-50-3	p-Phenylenediamine	1.0E+04 nc	1.0E+05 max	6.9E+02 nc	6.9E+03 nc		
	8.0E-05 i		8.0E-05 r	0	0.10	62-38-4	Phenylmercuric acetate	4.4E+00 nc	8.6E+01 nc	2.9E-01 nc	2.9E+00 nc		
1.9E-03 h		1.9E-03 r		0	0.10	90-43-7	2-Phenylphenol	2.3E+02 ca	1.5E+03 ca	3.5E+00 ca	3.5E+01 ca		
	2.0E-04 h		2.0E-04 r	0	0.10	298-02-2	Phorate	1.1E+01 nc	2.1E+02 nc	7.3E-01 nc	7.3E+00 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	732-11-6	Phosmet	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS	
				V	skin							Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	O C	abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	3.0E-04 h		8.6E-05 i	0	0.10	7803-51-2	Phosphine	1.6E+01 nc	3.2E+02 nc	3.1E-01 nc	1.1E+01 nc		
			2.9E-03 i	n/a	n/a	7664-38-2	Phosphoric acid			1.0E+01 nc			
	2.0E-05 i			0	0.01	7723-14-0	Phosphorus (white)	1.5E+00 nc	3.7E+01 nc		7.3E-01 nc		
	1.0E+00 h		1.0E+00 r	0	0.10	100-21-0	p-Phthalic acid	5.5E+04 nc	1.0E+05 max	3.7E+03 nc	3.7E+04 nc		
	2.0E+00 i		3.4E-02 h	0	0.10	85-44-9	Phthalic anhydride	1.0E+05 max	1.0E+05 max	1.2E+02 nc	7.3E+04 nc		
	7.0E-02 i		7.0E-02 r	0	0.10	1918-02-1	Picloram	3.8E+03 nc	7.5E+04 nc	2.6E+02 nc	2.6E+03 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	23505-41-1	Pirimiphos-methyl	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
8.9E+00 h	7.0E-06 h	8.9E+00 r	7.0E-06 r	0	0.10		Polybrominated biphenyls	5.0E-02 ca**	3.4E-01 ca*	7.6E-04 ca*	7.6E-03 ca*		
2.0E+00 i		**2.0E+00 r**		0	0.14	1336-36-3	**Polychlorinated biphenyls (PCBs)**	2.0E-01 ca**	1.3E+00 ca*	3.4E-03 ca*	3.4E-02 ca*		
	7.0E-05 i		7.0E-05 r	0	0.14	12674-11-2	Aroclor 1016 (see PCBs for cancer endpoint)	3.4E+00 nc	6.3E+01 nc	2.6E-01 nc	2.6E+00 nc		
	2.0E-05 i		2.0E-05 r	0	0.14	11097-69-1	Aroclor 1254 (see PCBs for cancer endpoint)	9.7E-01 nc	1.8E+01 nc	7.3E-02 nc	7.3E-01 nc		
					0.13		Polynuclear aromatic hydrocarbons (PAHs)						
	6.0E-02 i		6.0E-02 r	1	0.13	83-32-9	Acenaphthene	2.6E+03 nc	2.8E+04 nc	2.2E+02 nc	3.7E+02 nc	5.7E+02	2.9E+01
	3.0E-01 i		3.0E-01 r	1	0.13	120-12-7	Anthracene	1.4E+04 nc	2.2E+05 nc	1.1E+03 nc	1.8E+03 nc	1.2E+04	5.9E+02
7.3E-01 n		3.1E-01 n		0	0.13	56-55-3	**Benz[a]anthracene**	5.6E-01 ca	3.6E+00 ca	2.2E-02 ca	9.2E-02 ca	2.0E+00	8.0E-02
7.3E-01 n		3.1E-01 n		0	0.13	205-99-2	**Benzo[b]fluoranthene**	5.6E-01 ca	3.6E+00 ca	2.2E-02 ca	9.2E-02 ca	5.0E+00	2.0E-01
7.3E-02 n		3.1E-02 n		0	0.13	207-08-9	**Benzo[k]fluoranthene**	5.6E+00 ca	3.6E+01 ca	2.2E-01 ca	9.2E-01 ca	4.9E+01	2.0E+00
							"CAL-Modified PRG" (PEA, 1994)	**6.1E-01**					
7.3E+00 i		3.1E+00 n		0	0.13	50-32-8	**Benzo[a]pyrene**	5.6E-02 ca	3.6E-01 ca	2.2E-03 ca	9.2E-03 ca	8.0E+00	4.0E-01
							"CAL-Modified PRG" (PEA, 1994)				**1.5E-03**		
7.3E-03 n		3.1E-03 n		0	0.13	218-01-9	**Chrysene**	5.6E+01 ca	3.6E+02 ca	2.2E+00 ca	9.2E+00 ca	1.6E+02	8.0E+00
							"CAL-Modified PRG" (PEA, 1994)	**6.1E+00**					
7.3E+00 n		3.1E+00 n		0	0.13	53-70-3	**Dibenz[ah]anthracene**	5.6E-02 ca	3.6E-01 ca	2.2E-03 ca	9.2E-03 ca	2.0E+00	8.0E-02
	4.0E-02 i		4.0E-02 r	0	0.13	206-44-0	Fluoranthene	2.0E+03 nc	3.7E+04 nc	1.5E+02 nc	1.5E+03 nc	4.3E+03	2.1E+02
	4.0E-02 i		4.0E-02 r	1	0.13	86-73-7	Fluorene	1.8E+03 nc	2.2E+04 nc	1.5E+02 nc	2.4E+02 nc	5.6E+02	2.8E+01
7.3E-01 n		3.1E-01 n		0	0.13	193-39-5	**Indeno[1,2,3-cd]pyrene**	5.6E-01 ca	3.6E+00 ca	2.2E-02 ca	9.2E-02 ca	1.4E+01	7.0E-01
	2.0E-02 i		**8.6E-04 i**	1	0.13	91-20-3	**Naphthalene**	5.5E+01 nc	1.9E+02 nc	3.1E+00 nc	6.2E+00 nc	8.4E+01	4.0E+00
	3.0E-02 i		3.0E-02 r	1	0.13	129-00-0	Pyrene	1.5E+03 nc	2.6E+04 nc	1.1E+02 nc	1.8E+02 nc	4.2E+03	2.1E+02
1.5E-01 i	9.0E-03 i	1.5E-01 r	9.0E-03 r	0	0.10	67747-09-5	Prochloraz	3.0E+00 ca	2.0E+01 ca	4.5E-02 ca	3.3E+02 ca		
	6.0E-03 h		6.0E-03 r	0	0.10	26399-36-0	Profluralin	3.3E+02 nc	6.4E+03 nc	2.2E+01 nc	2.2E+02 nc		
	1.5E-02 i		1.5E-02 r	0	0.10	1610-18-0	Prometon	8.2E+02 nc	1.6E+04 nc	5.5E+01 nc	5.5E+02 nc		
	4.0E-03 i		4.0E-03 r	0	0.10	7287-19-6	Prometryn	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc		
	7.5E-02 i		7.5E-02 r	0	0.10	23950-58-5	Pronamide	4.1E+03 nc	8.0E+04 nc	2.7E+02 nc	2.7E+03 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	1918-16-7	Propachlor	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	709-98-8	Propanil	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	2312-35-8	Propargite	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	2.0E-03 i		2.0E-03 r	0	0.10	107-19-7	Propargyl alcohol	1.1E+02 nc	2.1E+03 nc	7.3E+00 nc	7.3E+01 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	139-40-2	Propazine	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	2.0E-02 i		2.0E-02 r	0	0.10	122-42-9	Propham	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	60207-90-1	Propiconazole	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	1.0E-02 n		**1.0E-02 r**	1	0.10	SU 104-5-18	**Iso-Propylbenzene**	1.2E+02 nc	4.9E+02 nc	3.7E+01 nc	6.1E+01 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	1.0E-02 n		1.0E-02 r	1	0.10	SU 104-51-8	**n-Propylbenzene**	1.3E+02 nc	5.5E+02 nc	3.7E+01 nc	6.1E+01 nc		
	2.0E+01 h		2.0E+01 r	0	0.10	57-55-6	Propylene glycol	1.0E+05 max	1.0E+05 max	7.3E+04 nc	7.3E+05 nc		
	7.0E-01 h		7.0E-01 r	0	0.10	111-35-3	Propylene glycol, monoethyl ether	3.8E+04 nc	1.0E+05 max	2.6E+03 nc	2.6E+04 nc		
	7.0E-01 h		5.7E-01 i	0	0.10	107-98-2	Propylene glycol, monomethyl ether	3.8E+04 nc	1.0E+05 max	2.1E+03 nc	2.6E+04 nc		
2.4E-01 i	8.6E-03 r	1.3E-02 i	8.6E-03 i	1	0.10	75-56-9	Propylene oxide	1.5E+00 ca	6.8E+00 ca	5.2E-01 ca*	2.2E-01 ca		
	2.5E-01 i		2.5E-01 r	0	0.10	81335-77-5	Pursuit	1.4E+04 nc	1.0E+05 max	9.1E+02 nc	9.1E+03 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	51630-58-1	Pydrin	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	110-86-1	Pyridine	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	5.0E-04 i		5.0E-04 r	0	0.10	13593-03-8	Quinalphos	2.7E+01 nc	5.3E+02 nc	1.8E+00 nc	1.8E+01 nc		
1.2E+01 h		1.2E+01 r		0	0.10	91-22-5	Quinoline	3.7E-02 ca	2.5E-01 ca	5.6E-04 ca	5.6E-03 ca		
1.1E-01 i	3.0E-03 i	1.1E-01 r	3.0E-03 r	0	0.10	121-82-4	RDX (Cyclonite)	4.0E+00 ca*	2.7E+01 ca	6.1E-02 ca	6.1E-01 ca		
	3.0E-02 i		3.0E-02 r	0	0.10	10453-86-8	Resmethrin	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	5.0E-02 h		5.0E-02 r	0	0.10	299-84-3	Ronnel	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		
	4.0E-03 i		4.0E-03 r	0	0.10	83-79-4	Rotenone	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	78587-05-0	Savey	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	5.0E-03 i			0	0.10	7783-00-8	Selenious Acid	2.7E+02 nc	5.3E+03 nc		1.8E+02 nc		
	5.0E-03 i			0	0.01	7782-49-2	Selenium	3.7E+02 nc	9.4E+03 nc		1.8E+02 nc	5.0E+00	3.0E-01
	5.0E-03 h			0	0.10	630-10-4	Selenourea	2.7E+02 nc	5.3E+03 nc		1.8E+02 nc		
	9.0E-02 i		9.0E-02 r	0	0.10	74051-80-2	Sethoxydim	4.9E+03 nc	9.6E+04 nc	3.3E+02 nc	3.3E+03 nc		
	5.0E-03 i			0	0.01	7440-22-4	Silver and compounds	3.7E+02 nc	9.4E+03 nc		1.8E+02 nc	3.4E+01	2.0E+00
1.2E-01 h	5.0E-03 i	1.2E-01 r	2.0E-03 r	0	0.10	122-34-9	Simazine	3.7E+00 ca*	2.5E+01 ca	5.6E-02 ca	5.6E-01 ca		
	4.0E-03 i		4.0E-03 r	0	0.10	26628-22-8	Sodium azide	2.2E+02 nc	4.3E+03 nc	1.5E+01 nc	1.5E+02 nc		
2.7E-01 h	3.0E-02 i	2.7E-01 r	3.0E-02 r	0	0.10	148-18-5	Sodium diethyldithiocarbamate	1.6E+00 ca	1.1E+01 ca	2.5E-02 ca	2.5E-01 ca		
	2.0E-05 i		2.0E-05 r	0	0.10	62-74-8	Sodium fluoroacetate	1.1E+00 nc	2.1E+01 nc	7.3E-02 nc	7.3E-01 nc		
	1.0E-03 h		1.0E-03 r	0	0.10	13718-26-8	Sodium metavanadate	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	6.0E-01 i			0	0.01	7440-24-6	Strontium, stable	4.5E+04 nc	1.0E+05 max		2.2E+04 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	57-24-9	Strychnine	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
	2.0E-01 i		2.9E-01 i	1	0.10	100-42-5	Styrene	1.7E+03 sat	1.7E+03 sat	1.1E+03 nc	1.6E+03 nc	4.0E+00	2.0E-01
	2.5E-02 i		2.5E-02 r	0	0.10	88671-89-0	Systhane	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
1.5E+05 h		1.5E+05 h		0	0.03	1746-01-6	2,3,7,8-TCDD (dioxin)	3.8E-06 ca	3.0E-05 ca	4.5E-08 ca	4.5E-07 ca		
	7.0E-02 i		7.0E-02 r	0	0.10	34014-18-1	Tebuthiuron	3.8E+03 nc	7.5E+04 nc	2.6E+02 nc	2.6E+03 nc		
	2.0E-02 h		2.0E-02 r	0	0.10	3383-96-8	Temephos	1.1E+03 nc	2.1E+04 nc	7.3E+01 nc	7.3E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	5902-51-2	Terbacil	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	2.5E-05 h		2.5E-05 r	0	0.10	13071-79-9	Terbufos	1.4E+00 nc	2.7E+01 nc	9.1E-02 nc	9.1E-01 nc		
	1.0E-03 i		1.0E-03 r	0	0.10	886-50-0	Terbutryn	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	3.0E-04 i		3.0E-04 r	0	0.10	95-94-3	1,2,4,5-Tetrachlorobenzene	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
2.6E-02 i	3.0E-02 i	2.6E-02 i	3.0E-02 r	1	0.10	630-20-6	1,1,1,2-Tetrachloroethane	2.8E+00 ca	6.8E+00 ca	2.6E-01 ca	4.3E-01 ca		
2.0E-01 i		2.0E-01 i		1	0.10	79-34-5	1,1,2,2-Tetrachloroethane	3.6E-01 ca	8.7E-01 ca	3.3E-02 ca	5.5E-02 ca	3.0E-03	2.0E-04
5.2E-02 n	1.0E-02 i	2.0E-03 n	1.1E-01 n	1	0.10	127-18-4	**Tetrachloroethylene (PCE)**	4.7E+00 ca*	1.6E+01 ca	3.3E+00 ca	1.1E+00 ca	6.0E-02	3.0E-03
							"CAL-Modified PRG" (PEA, 1994)			**3.2E-01**			
	3.0E-02 i		3.0E-02 r	0	0.10	58-90-2	2,3,4,6-Tetrachlorophenol	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
2.0E+01 h		2.0E+01 r		0	0.10	5216-25-1	p,a,a,a-Tetrachlorotoluene	2.2E-02 ca	1.5E-01 ca	3.4E-04 ca	3.4E-03 ca		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
2.4E-02 h	3.0E-02 i	2.4E-02 r	3.0E-02 r	0	0.10	961-11-5	Tetrachlorovinphos	1.9E+01 ca*	1.2E+02 ca	2.8E-01 ca	2.8E+00 ca		
	5.0E-04 i		5.0E-04 r	0	0.10	3689-24-5	Tetraethyldithiopyrophosphate	2.7E+01 nc	5.3E+02 nc	1.8E+00 nc	1.8E+01 nc		
	8.6E-02 r		8.6E-02 n	0	0.10	109-99-9	**Tetrahydrofuran**	4.7E+03 nc	9.2E+04 nc	3.1E+02 nc	3.1E+03 nc		
	7.0E-05 h			0	0.01	1314-32-5	Thallic oxide	5.2E+00 nc	1.3E+02 nc		2.6E+00 nc		
	9.0E-05 i			0	0.01	563-68-8	Thallium acetate	6.7E+00 nc	1.7E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	6533-73-9	Thallium carbonate	6.0E+00 nc	1.5E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	7791-12-0	Thallium chloride	6.0E+00 nc	1.5E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	9.0E-05 i			0	0.01	10102-45-1	Thallium nitrate	6.7E+00 nc	1.7E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	9.0E-05 x			0	0.01	12039-52-0	Thallium selenite	6.7E+00 nc	1.7E+02 nc		3.3E+00 nc	7.0E-01	4.0E-01
	8.0E-05 i			0	0.01	7446-18-6	Thallium sulfate	6.0E+00 nc	1.5E+02 nc		2.9E+00 nc	7.0E-01	4.0E-01
	1.0E-02 i		1.0E-02 r	0	0.10	28249-77-6	Thiobencarb	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	1.0E-01 n		1.0E-01 r	0	0.10	N/A	**Thiocyanate**	5.5E+03 nc	1.0E+05 max	3.7E+02 nc	3.7E+03 nc		
	3.0E-02 x		3.0E-02 r	0	0.10	21564-17-0	2-(Thiocyanomethylthio)- benzothiazole (TCMTB)	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	3.0E-04 h		3.0E-04 r	0	0.10	39196-18-4	Thiofanox	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
	8.0E-02 i		8.0E-02 r	0	0.10	23564-05-8	Thiophanate-methyl	4.4E+03 nc	8.6E+04 nc	2.9E+02 nc	2.9E+03 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	137-26-8	Thiram	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	6.0E-01 h			0	0.01	n/a	Tin (inorganic, see tributyltin oxide for organic tin)	4.5E+04 nc	1.0E+05 max		2.2E+04 nc		
	2.0E-01 i		1.1E-01 h	1	0.10	108-88-3	Toluene	5.2E+02 sat	5.2E+02 sat	4.0E+02 nc	7.2E+02 nc	1.2E+01	6.0E-01
3.2E+00 h		3.2E+00 r		0	0.10	95-80-7	Toluene-2,4-diamine	1.4E-01 ca	9.4E-01 ca	2.1E-03 ca	2.1E-02 ca		
	6.0E-01 h		6.0E-01 r	0	0.10	95-70-5	Toluene-2,5-diamine	3.3E+04 nc	1.0E+05 max	2.2E+03 nc	2.2E+04 nc		
	2.0E-01 h		2.0E-01 r	0	0.10	823-40-5	Toluene-2,6-diamine	1.1E+04 nc	1.0E+05 max	7.3E+02 nc	7.3E+03 nc		
1.9E-01 i		1.9E-01 r		0	0.10	106-49-0	p-Toluidine	2.3E+00 ca	1.6E+01 ca	3.5E-02 ca	3.5E-01 ca		
1.1E+00 i		1.1E+00 i		0	0.10	8001-35-2	Toxaphene	4.0E-01 ca	2.7E+00 ca	6.0E-03 ca	6.1E-02 ca	3.1E+01	2.0E+00
	7.5E-03 i		7.5E-03 r	0	0.10	66841-25-6	Tralomethrin	4.1E+02 nc	8.0E+03 nc	2.7E+01 nc	2.7E+02 nc		
	1.3E-02 i		1.3E-02 r	0	0.10	2303-17-5	Triallate	7.1E+02 nc	1.4E+04 nc	4.7E+01 nc	4.7E+02 nc		
	1.0E-02 i		1.0E-02 r	0	0.10	82097-50-5	Triasulfuron	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	5.0E-03 i		5.0E-03 r	0	0.10	615-54-3	1,2,4-Tribromobenzene	2.7E+02 nc	5.3E+03 nc	1.8E+01 nc	1.8E+02 nc		
	3.0E-04 i			0	0.10	56-35-9	**Tributyltin oxide (TBTO)**	1.6E+01 nc	3.2E+02 nc		1.1E+01 nc		
3.4E-02 h		3.4E-02 r		0	0.10	634-93-5	2,4,6-Trichloroaniline	1.3E+01 ca	8.8E+01 ca	2.0E-01 ca	2.0E+00 ca		
2.9E-02 h		2.9E-02 r		0	0.10	33663-50-2	2,4,6-Trichloroaniline hydrochloride	1.5E+01 ca	1.0E+02 ca	2.3E-01 ca	2.3E+00 ca		
	1.0E-02 i		5.7E-02 h	1	0.10	120-82-1	1,2,4-Trichlorobenzene	4.8E+02 nc	1.7E+03 sat	2.1E+02 nc	1.9E+02 nc	5.0E+00	3.0E-01
	3.5E-02 n		2.9E-01 n	1	0.10	71-55-6	1,1,1-Trichloroethane	6.8E+02 nc	1.4E+03 sat	1.0E+03 nc	7.9E+02 nc	2.0E+00	1.0E-01
5.7E-02 i	4.0E-03 i	5.6E-02 i	4.0E-03 r	1	0.10	79-00-5	1,1,2-Trichloroethane	8.2E-01 ca*	1.9E+00 ca*	1.2E-01 ca	2.0E-01 ca	2.0E-02	9.0E-04
1.1E-02 n	6.0E-03 x	6.0E-03 n	6.0E-03 r	1	0.10	79-01-6	Trichloroethylene (TCE)	2.7E+00 ca**	6.1E+00 ca*	1.1E+00 ca*	1.6E+00 ca*	6.0E-02	3.0E-03
	3.0E-01 i		2.0E-01 h	1	0.10	75-69-4	Trichlorofluoromethane	3.8E+02 nc	1.3E+03 nc	7.3E+02 nc	1.3E+03 nc		
	1.0E-01 i		1.0E-01 r	0	0.10	95-95-4	2,4,5-Trichlorophenol	5.5E+03 nc	1.1E+05 nc	3.7E+02 nc	3.7E+03 nc	2.7E+02	1.4E+01
1.1E-02 i		1.1E-02 i		0	0.10	88-06-2	2,4,6-Trichlorophenol	4.0E+01 ca	2.7E+02 ca	6.2E-01 ca	6.1E+00 ca	2.0E-01	8.0E-03
	1.0E-02 i		1.0E-02 r	0	0.10	93-76-5	2,4,5-Trichlorophenoxyacetic Acid	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
	8.0E-03 i		8.0E-03 r	0	0.10	93-72-1	2-(2,4,5-Trichlorophenoxy) propionic acid	4.4E+02 nc	8.6E+03 nc	2.9E+01 nc	2.9E+02 nc		
	5.0E-03 i		5.0E-03 r	1	0.10	598-77-6	1,1,2-Trichloropropane	1.5E+01 nc	5.1E+01 nc	1.8E+01 nc	3.0E+01 nc		
7.0E+00 h	6.0E-03 i	7.0E+00 r	5.0E-03 r	1	0.10	96-18-4	1,2,3-Trichloropropane	1.4E-03 ca	3.1E-03 ca	9.6E-04 ca	1.6E-03 ca		
	5.0E-03 h		5.0E-03 r	1	0.10	SU 96-19-5	1,2,3-Trichloropropene	1.1E+01 nc	3.8E+01 nc	1.8E+01 nc	3.0E+01 nc		

Key : i=IRIS h=HEAST n=NCEA x=WITHDRAWN o=Other EPA DOCUMENTS r=ROUTE EXTRAPOLATION ca=CANCER PRG nc=NONCANCER PRG sat=SOIL SATURATION max=CEILING LIMIT *(where: nc < 100X ca) **(where: nc < 10X ca)

FOR PLANNING PURPOSES

TOXICITY INFORMATION							CONTAMINANT	PRELIMINARY REMEDIAL GOALS (PRGs)				SOIL SCREENING LEVELS Migration to Ground Water	
SFo 1/(mg/kg-d)	RfDo (mg/kg-d)	SFi 1/(mg/kg-d)	RfDi (mg/kg-d)	VOC	skin abs. soils	CAS No.		Residential Soil (mg/kg)	Industrial Soil (mg/kg)	Ambient Air (ug/m^3)	Tap Water (ug/l)	DAF 20 (mg/kg)	DAF 1 (mg/kg)
	3.0E+01 i		8.6E+00 h	1	0.10	76-13-1	1,1,2-Trichloro-1,2,2-trifluoroethane	5.6E+03 sat	5.6E+03 sat	3.1E+04 nc	5.9E+04 nc		
	3.0E-03 i		3.0E-03 r	0	0.10	58138-08-2	Tridiphane	1.6E+02 nc	3.2E+03 nc	1.1E+01 nc	1.1E+02 nc		
	2.0E-03 r		2.0E-03 i	1	0.10 SU	121-44-8	Triethylamine	2.2E+01 nc	8.6E+01 nc	7.3E+00 nc	1.2E+01 nc		
7.7E-03 i	7.5E-03 i	7.7E-03 r	7.5E-03 r	0	0.10	1582-09-8	Trifluralin	5.8E+01 ca**	3.9E+02 ca*	8.7E-01 ca*	8.7E+00 ca*		
	5.0E-02 n		**1.7E-03 n**	1	0.10	95-63-6	**1,2,4-Trimethylbenzene**	5.1E+01 nc	1.7E+02 nc	6.2E+00 nc	1.2E+01 nc		
	5.0E-02 n		**1.7E-03 n**	1	0.10	108-67-8	**1,3,5-Trimethylbenzene**	2.1E+01 nc	7.0E+01 nc	6.2E+00 nc	1.2E+01 nc		
3.7E-02 h		3.7E-02 r		0	0.10	512-56-1	Trimethyl phosphate	1.2E+01 ca	8.1E+01 ca	1.8E-01 ca	1.8E+00 ca		
	3.0E-02 i		**3.0E-02 r**	0	0.10	99-35-4	**1,3,5-Trinitrobenzene**	1.6E+03 nc	3.2E+04 nc	1.1E+02 nc	1.1E+03 nc		
	1.0E-02 h		1.0E-02 r	0	0.10	479-45-8	Trinitrophenylmethylnitramine	5.5E+02 nc	1.1E+04 nc	3.7E+01 nc	3.7E+02 nc		
3.0E-02 i	5.0E-04 i	3.0E-02 r	5.0E-04 r	0	0.10	118-96-7	2,4,6-Trinitrotoluene	1.5E+01 ca**	1.0E+02 ca**	2.2E-01 ca**	2.2E+00 ca**		
	7.0E-03 h			0	0.01	7440-62-2	Vanadium	5.2E+02 nc	1.3E+04 nc		2.6E+02 nc	6.0E+03	3.0E+02
	9.0E-03 i			0	0.01	1314-62-1	Vanadium pentoxide	6.7E+02 nc	1.7E+04 nc		3.3E+02 nc	6.0E+03	3.0E+02
	2.0E-02 h			0	0.01	13701-70-7	Vanadium sulfate	1.5E+03 nc	3.7E+04 nc		7.3E+02 nc	6.0E+03	3.0E+02
	1.0E-03 i		1.0E-03 r	0	0.10	1929-77-7	Vernam	5.5E+01 nc	1.1E+03 nc	3.7E+00 nc	3.7E+01 nc		
	2.5E-02 i		2.5E-02 r	0	0.10	50471-44-8	Vinclozolin	1.4E+03 nc	2.7E+04 nc	9.1E+01 nc	9.1E+02 nc		
	1.0E+00 h		5.7E-02 i	1	0.10	108-05-4	Vinyl acetate	4.2E+02 nc	1.4E+03 nc	2.1E+02 nc	4.1E+02 nc	1.7E+02	8.0E+00
1.1E-01 r	8.6E-04 r	1.1E-01 h	8.6E-04 i	1	0.10 SU	593-60-2	Vinyl bromide (bromoethene)	1.9E-01 ca*	4.2E-01 ca*	6.1E-02 ca*	1.0E-01 ca*		
1.9E+00 h		3.0E-01 h		1	0.10	75-01-4	Vinyl chloride	2.1E-02 ca	4.8E-02 ca	2.2E-02 ca	2.0E-02 ca	1.0E-02	7.0E-04
	3.0E-04 i		3.0E-04 r	0	0.10	81-81-2	Warfarin	1.6E+01 nc	3.2E+02 nc	1.1E+00 nc	1.1E+01 nc		
	2.0E+00 i		2.0E-01 x	1	0.10	108-38-3	m-Xylene	2.1E+02 sat	2.1E+02 sat	7.3E+02 nc	1.4E+03 nc	2.1E+02	1.0E+01
	2.0E+00 i		2.0E-01 x	1	0.10	95-47-6	o-Xylene	2.8E+02 sat	2.8E+02 sat	7.3E+02 nc	1.4E+03 nc	1.9E+02	9.0E+00
				1	0.10	106-42-3	p-Xylene	3.7E+02 sat	3.7E+02 sat			2.0E+02	1.0E+01
	3.0E-01 i			0	0.01	7440-66-6	Zinc	2.2E+04 nc	1.0E+05 max		1.1E+04 nc	1.2E+04	6.2E+02
	3.0E-04 i			0	0.01	1314-84-7	Zinc phosphide	2.2E+01 nc	5.6E+02 nc		1.1E+01 nc		
	5.0E-02 i		5.0E-02 r	0	0.10	12122-67-7	Zineb	2.7E+03 nc	5.3E+04 nc	1.8E+02 nc	1.8E+03 nc		

APPENDIX D

USEPA REGION 3 RISK-BASED CONCENTRATIONS

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
ACETALDEHYDE	75070			2.57E-003 I	7.7E-003 I			8.1E-001 C			
ACETOCHLOR	34256821	2E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
ACETONE	67641	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ACETONITRILE	75058	6.00E-003 I		1.40E-002 A			2.2E+002 N	5.1E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
ACETOPHENONE	98862	1.00E-001 I		5.70E-006 W		y	4.2E-002 N	2.1E-002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ACROLEIN	107028	2.00E-002 H		5.70E-006 I		y	4.2E-002 N	2.1E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
ACRYLAMIDE	79061	2.00E-004 I	4.50E+000 I		4.50E+000 I		1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C
ACRYLONITRILE	107131	1.00E-003 H	5.40E-001 I	5.70E-004 I	2.40E-001 I		1.2E-001 C	2.6E-002 C	5.8E-003 C	1.1E+001 C	1.2E+000 C
ALACHLOR	15972608	1.00E-002 I	8.00E-002 H				8.4E-001 C	7.8E-002 C	3.9E-002 C	7.2E+001 C	8.0E+000 C
ALAR	1596845	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N
ALDICARB	116063	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
ALDICARB SULFONE	1646884	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
ALDRIN	309002	3.00E-005 I	1.70E+001 I		1.70E+001 I		3.9E-003 C	3.7E-004 C	1.9E-004 C	3.4E-001 C	3.8E-002 C
ALUMINUM	7429905	1.00E+000 E		1.00E-003 E			3.7E+004 N	3.7E+000 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
AMINODINITROTOLUENES		6.00E-005 E					2.2E+000 N	2.2E-001 N	8.1E-002 N	1.2E+002 N	4.7E+000 N
4-AMINOPYRIDINE	504245	2.00E-005 H					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N
AMMONIA	7664417			2.86E-002 I		y	2.1E+002 N	1.0E+002 N			
ANILINE	62533		5.70E-003 I	2.90E-004 I		y	1.9E+000 C !	1.1E+000 N	5.5E-001 C	1.0E+003 C	1.1E+002 C
ANTIMONY	7440360	4.00E-004 I					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ANTIMONY PENTOXIDE	1314609	5.00E-004 H					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N
ANTIMONY TETROXIDE	1332816	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ANTIMONY TRIOXIDE	1309644	4.00E-004 H		5.70E-005 I			1.5E+001 N	2.1E-001 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
ARSENIC	7440382	3.00E-004 I	1.50E+000 I		1.51E+001 I		4.5E-002 C	4.1E-004 C	2.1E-003 C	3.8E+000 C	4.3E-001 C
ARSINE	7784421			1.40E-005 I		y	1.0E-001 N	5.1E-002 N			
ASSURE	76578148	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N
ATRAZINE	1912249	3.50E-002 I	2.20E-001 H				3.0E-001 C	2.8E-002 C	1.4E-002 C	2.6E+001 C	2.9E+000 C
AZOBENZENE	103333		1.10E-001 I		1.10E-001 I		6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C
BARIUM	7440393	7.00E-002 I		1.40E-004 A			2.6E+003 N	5.1E-001 N	9.5E+001 N	1.4E+005 N	5.5E+003 N
BAYGON	114261	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
BAYTHROID	68359375	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N
BENTAZON	25057890	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
BENZALDEHYDE	100527	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
BENZENE	71432	3.00E-003 E	2.90E-002 I	1.70E-003 E	2.90E-002 I	y	3.6E-001 C	2.2E-001 C	1.1E-001 C	2.0E+002 C	2.2E+001 C
BENZENETHIOL	108985	1.00E-005 H				y	6.1E-002 N	3.7E-002 N	1.4E-002 N	2.0E+001 N	7.8E-001 N
BENZIDINE	92875	3.00E-003 I	2.30E+002 I		2.30E+002 I		2.9E-004 C	2.7E-005 C	1.4E-005 C	2.5E-002 C	2.8E-003 C
BENZOIC ACID	65850	4.00E+000 I					1.5E+005 N	1.5E+004 N	5.4E+003 N	8.2E+006 N	3.1E+005 N
BENZYL ALCOHOL	100516	3.00E-001 H					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
BENZYL CHLORIDE	100447		0.17 I			y	6.2E-002 C	3.7E-002 C	1.9E-002 C	3.4E+001 C	3.8E+000 C
BERYLLIUM	7440417	2.00E-003 I		5.7E-006 I	8.40E+000 I		7.3E+001 N	7.5E-004 C	2.7E+000 N	4.1E+003 N	1.6E+002 N
BIPHENYL	92524	5.00E-002 I				y	3.0E+002 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
BIS(2-CHLOROETHYL)ETHER	111444		1.10E+000 I		1.10E+000 I		6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C
BIS(2-CHLOROISOPROPYL)ETHER	108601	4.00E-002 I	7.00E-002 H		3.50E-002 H	y	2.6E-001 C	1.8E-001 C	4.5E-002 C	8.2E+001 C	9.1E+000 C
**BIS(CHLOROMETHYL)ETHER	542881		2.20E+002 I		2.20E+002 I	y	4.8E-005 C	2.8E-005 C	1.4E-005 C	2.6E-002 C	2.9E-003 C
**BIS(2-ETHYLHEXYL)PHTHALATE	117817	2.00E-002 I	1.40E-002 I		1.40E-002 E		4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C
**BORON	7440428	9.00E-002 I		5.70E-003 H			3.3E+003 N	2.1E+001 N	1.2E+002 N	1.8E+005 N	7.0E+003 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
BROMODICHLOROMETHANE	75274	2.00E-002 I	6.20E-002 I			y	1.7E-001 C	1.0E-001 C	5.1E-002 C	9.2E+001 C	1.0E+001 C
'''BROMOETHENE	593602			8.6E-004 I	1.10E-001 H	y	1.1E-001 C	5.7E-002 C			
BROMOFORM	75252	2.00E-002 I	7.90E-003 I		3.90E-003 I	y	2.3E+000 C	1.6E+000 C	4.0E-001 C	7.2E+002 C	8.1E+001 C
BROMOMETHANE	74839	1.40E-003 I		1.40E-003 I		y	8.5E+000 N	5.1E+000 N	1.9E+000 N	2.9E+003 N	1.1E+002 N
BROMOPHOS	2104963	5.00E-003 H				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
1,3-BUTADIENE	106990				1.80E+000 H	y	7.0E-003 C	3.5E-003 C			
1-BUTANOL	71363	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
BUTYLBENZYLPHTHALATE	85687	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
BUTYLATE	2008415	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
N-BUTYLBENZENE	104518	1.00E-002 E				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
SEC-BUTYLBENZENE	135988	1.00E-002 E				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
TERT-BUTYLBENZENE	98066	1.00E-002 E				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
CADMIUM-WATER	7440439	5.00E-004 I			6.30E+000 I		1.8E+001 N	9.9E-004 C	6.8E-001 N	1.0E+003 N	3.9E+001 N
CADMIUM-FOOD	7440439	1.00E-003 I			6.30E+000 I		3.7E+001 N	9.9E-004 C	1.4E+000 N	2.0E+003 N	7.8E+001 N
CAPROLACTAM	105602	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N
CARBARYL	63252	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
CARBON DISULFIDE	75150	1.00E-001 I		2.00E-001 I		y	1.0E+003 N	7.3E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
CARBON TETRACHLORIDE	56235	7.00E-004 I	1.30E-001 I	5.71E-004 E	5.30E-002 I	y	1.6E-001 C	1.2E-001 C	2.4E-002 C	4.4E+001 C	4.9E+000 C
CARBOSULFAN	55285148	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
CHLORAL	75876	2.00E-003 I				y	1.2E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
CHLORANIL	118752		4.00E-001 H				1.7E-001 C	1.6E-002 C	7.9E-003 C	1.4E+001 C	1.6E+000 C
CHLORDANE	57749	5.00E-004 I	3.5E-001 I	2.00E-004 I	3.5E-001 I		1.9E-001 C	1.8E-002 C	9.0E-003 C	1.6E+001 C	1.8E+000 C
CHLORINE	7782505	1.00E-001 I				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
CHLORINE DIOXIDE	10049044			5.70E-005 I		y	4.2E-001 N	2.1E-001 N			
CHLOROACETIC ACID	79118	2.00E-003 H					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
4-CHLOROANILINE	106478	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
CHLOROBENZENE	108907	2.00E-002 I		5.00E-003 A		y	3.5E+001 N	1.8E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
CHLOROBENZILATE	510156	2.00E-002 I	2.70E-001 H		2.70E-001 H		2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C
P-CHLOROBENZOIC ACID	74113	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
2-CHLORO-1,3-BUTADIENE	126998	2.00E-002 A		2.00E-003 H		y	1.4E+001 N	7.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
1-CHLOROBUTANE	109693	4.00E-001 H				y	2.4E+003 N	1.5E+003 N	5.4E+002 N	8.2E+005 N	3.1E+004 N
1-CHLORO-1,1-DIFLUOROETHANE	75683			1.40E+001 I		y	1.0E+005 N	5.1E+004 N			
CHLORODIFLUOROMETHANE	75456			1.40E+001 I		y	1.0E+005 N	5.1E+004 N			
CHLOROETHANE	75003	4.00E-001 E	2.90E-003 E	2.90E+000 I		y	3.6E+000 C	2.2E+000 C	1.1E+000 C	2.0E+003 C	2.2E+002 C
CHLOROFORM	67663	1.00E-002 I	6.10E-003 I	8.6E-005 E	8.10E-002 I	y	1.5E-001 C I	7.7E-002 C I	6.2E-001 C	9.4E+002 C	1.0E+002 C I
CHLOROMETHANE	74873		1.30E-002 H		6.00E-003 H	y	1.5E+000 C	1.0E+000 C	2.4E-001 C	4.4E+002 C	4.9E+001 C
4-CHLORO-2-METHYLANILINE	95692		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C
BETA-CHLORONAPHTHALENE	91587	8.00E-002 I				y	4.9E+002 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N
O-CHLORONITROBENZENE	88733		2.50E-002 H			y	4.2E-001 C	2.5E-001 C	1.3E-001 C	2.3E+002 C	2.6E+001 C
P-CHLORONITROBENZENE	100005		1.80E-002 H			y	5.9E-001 C	3.5E-001 C	1.8E-001 C	3.2E+002 C	3.5E+001 C
2-CHLOROPHENOL	95578	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
2-CHLOROPROPANE	75296			2.90E-002 H		y	2.1E+002 N	1.1E+002 N			
O-CHLOROTOLUENE	95498	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
CHLORPYRIFOS	2921882	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
CHLORPYRIFOS-METHYL	5598130	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
**CHROMIUM III	16065831	1.50E+000 I					5.5E+004 N	5.5E+003 N	2.0E+003 N	3.1E+006 N	1.2E+005 N
**CHROMIUM VI	18540299	3.00E-003 I		3.00E-005 I	4.10E+001 H		1.1E+002 N	1.5E-004 C	4.1E+000 N	6.1E+003 N	2.3E+002 N
COBALT	7440484	6.00E-002 E					2.2E+003 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N
COKE OVEN EMISSIONS (COAL TAR)	8007452				2.2 I	y	5.7E-003 C	2.8E-003 C			
COPPER	7440508	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
CROTONALDEHYDE	123739		1.90E+000 H				3.5E-002 C	3.3E-003 C	1.7E-003 C	3.0E+000 C	3.4E-001 C
CUMENE	98828	1.00E-001 I		1.10E-001 I		y	6.6E+002 N	4.0E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
CYANIDE (FREE)	57125	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
CALCIUM CYANIDE	592018	4E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
COPPER CYANIDE	544923	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
CYANAZINE	21725462	2.00E-003 H	8.40E-001 H				8.0E-002 C	7.5E-003 C	3.8E-003 C	6.8E+000 C	7.6E-001 C
CYANOGEN	460195	4.00E-002 I				y	2.4E+002 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
CYANOGEN BROMIDE	506683	9.00E-002 I					3.3E+003 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N
CYANOGEN CHLORIDE	506774	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
HYDROGEN CYANIDE	74908	2.00E-002 I		8.60E-004 I		y	6.2E+000 N	3.1E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
POTASSIUM CYANIDE	151508	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
POTASSIUM SILVER CYANIDE	506616	2.00E-001 I					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
SILVER CYANIDE	506649	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
SODIUM CYANIDE	143339	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
THIOCYANATE		1.00E-001 E					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ZINC CYANIDE	557211	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
CYCLOHEXANONE	108941	5.00E+000 I					1.8E+005 N	1.8E+004 N	6.8E+003 N	1.0E+007 N	3.9E+005 N
CYHALOTHRIN/KARATE	68085858	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
CYPERMETHRIN	52315078	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
DACTHAL	1861321	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
DALAPON	75990	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
DDD	72548		2.40E-001 I				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C
DDE	72559		3.40E-001 I				2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C
DDT	50293	5.00E-004 I	3.40E-001 I		3.40E-001 I		2.0E-001 C	1.8E-002 C	9.3E-003 C	1.7E+001 C	1.9E+000 C
DIAZINON	333415	9.00E-004 H					3.3E+001 N	3.3E+000 N	1.2E+000 N	1.8E+003 N	7.0E+001 N
DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
1,4-DIBROMOBENZENE	106376	1.00E-002 I				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
DIBROMOCHLOROMETHANE	124481	2.00E-002 I	8.40E-002 I			y	1.3E-001 C	7.5E-002 C	3.8E-002 C	6.8E+001 C	7.6E+000 C
1,2-DIBROMO-3-CHLOROPROPANE	96128		1.40E+000 H	5.70E-005 I	2.40E-003 H	y	4.7E-002 C I	2.1E-001 N	2.3E-003 C	4.1E+000 C	4.6E-001 C
1,2-DIBROMOETHANE	106934		8.50E+001 I	5.70E-005 H	7.60E-001 I	y	7.5E-004 C	8.2E-003 C	3.7E-005 C	6.7E-002 C	7.5E-003 C
DIBUTYLPHTHALATE	84742	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
DICAMBA	1918009	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
1,2-DICHLOROBENZENE	95501	9.00E-002 I		9.00E-003 E		y	6.4E+001 N	3.3E+001 N	1.2E+002 N	1.8E+005 N	7.0E+003 N
1,3-DICHLOROBENZENE	541731	3.00E-002 E		2.00E-003 E		y	1.4E+001 N	7.3E+000 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
1,4-DICHLOROBENZENE	106467	3.00E-002 E	2.40E-002 H	2.29E-001 I	2.2E-002 E	y	4.7E-001 C	2.8E-001 C	1.3E-001 C	2.4E+002 C	2.7E+001 C
3,3'-DICHLOROBENZIDINE	91941		4.50E-001 I				1.5E-001 C	1.4E-002 C	7.0E-003 C	1.3E+001 C	1.4E+000 C
1,4-DICHLORO-2-BUTENE	764410				9.30E+000 H	y	1.3E-003 C	6.7E-004 C			
DICHLORODIFLUOROMETHANE	75718	2.00E-001 I		5.00E-002 A		y	3.5E+002 N	1.8E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
1,1-DICHLOROETHANE	75343	1.00E-001 H		1.40E-001 A		y	8.0E+002 N	5.1E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
1,2-DICHLOROETHANE	107062	3.00E-002 E	9.10E-002 I	1.40E-003 E	9.10E-002 I	y	1.2E-001 C	6.9E-002 C	3.5E-002 C	6.3E+001 C	7.0E+000 C

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA-NCEA provisional value O = other							Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
1,1-DICHLOROETHENE	75354	9.00E-003 I	6.00E-001 I		1.75E-001 I	y	4.4E-002 C	3.6E-002 C	5.3E-003 C	9.5E+000 C	1.1E+000 C
CIS-1,2-DICHLOROETHENE	156592	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
TRANS-1,2-DICHLOROETHENE	156605	2.00E-002 I				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
TOTAL 1,2-DICHLOROETHENE	540590	9.00E-003 H				y	5.5E+001 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N
2,4-DICHLOROPHENOL	120832	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
2,4-D	94757	1.00E-002 I				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
4-(2,4-DICHLOROPHENOXY)BUTYRIC ACID	94826	8E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N
1,2-DICHLOROPROPANE	78875		6.80E-002 H	1.14E-003 I		y	1.6E-001 C	9.2E-002 C	4.6E-002 C	8.4E+001 C	9.4E+000 C
2,3-DICHLOROPROPANOL	616239	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
1,3-DICHLOROPROPENE	542756	3.00E-004 I	1.80E-001 H	5.71E-003 I	1.30E-001 H	y	7.7E-002 C	4.8E-002 C	1.8E-002 C	3.2E+001 C	3.6E+000 C !
DICHLORVOS	62737	5E-004 I	0.29 I	1.43E-004 I			2.3E-001 C	2.2E-002 C	1.1E-002 C	2.0E+001 C	2.2E+000 C
DICOFOL	115322		*4.4E-001 W*				*1.5E-001 C*	*1.4E-002 C*	*7.2E-003 C*	*1.3E+001 C*	*1.5E+000 C*
DICYCLOPENTADIENE	77736	3E-002 H		6.00E-005 A		y	4.4E-001 N	2.2E-001 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
DIELDRIN	60571	5.00E-005 I	1.60E+001 I		1.60E+001 I		4.2E-003 C	3.9E-004 C	2.0E-004 C	3.6E-001 C	4.0E-002 C
DIESEL EMISSIONS				1.40E-003 I				5.1E+000 N			
DIETHYLPHTHALATE	84662	8.00E-001 I					2.9E+004 N	2.9E+003 N	1.1E+003 N	1.6E+006 N	6.3E+004 N
DIETHYLENE GLYCOL, MONOBUTYL ETHER	112345			5.70E-003 H				2.1E+001 N			
DIETHYLENE GLYCOL, MONOETHYL ETHER	111900	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
DI(2-ETHYLHEXYL)ADIPATE	103231	6.00E-001 I	1.20E-003 I				5.6E+001 C	5.2E+000 C	2.6E+000 C	4.8E+003 C	5.3E+002 C
DIETHYLSTILBESTROL	56531		4.70E+003 H				1.4E-005 C	1.3E-006 C	6.7E-007 C	1.2E-003 C	1.4E-004 C
DIFENZOQUAT (AVENGE)	43222486	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N
1,1-DIFLUOROETHANE	75376			1.10E+001 I		y	8.0E+004 N	4.0E+004 N			
DIISOPROPYL METHYLPHOSPHONATE (DIMP)	1445756	8.00E-002 I					2.9E+003 N	2.9E+002 N	1.1E+002 N	1.6E+005 N	6.3E+003 N
3,3'-DIMETHOXYBENZIDINE	119904		1.40E-002 H				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C
DIMETHYLAMINE	124403			5.70E-006 W				2.1E-002 N			
2,4-DIMETHYLANILINE HYDROCHLORIDE	21436964		5.80E-001 H				1.2E-001 C	1.1E-002 C	5.4E-003 C	9.9E+000 C	1.1E+000 C
2,4-DIMETHYLANILINE	95681		7.50E-001 H				8.9E-002 C	8.3E-003 C	4.2E-003 C	7.6E+000 C	8.5E-001 C
N,N-DIMETHYLANILINE	121697	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
3,3'-DIMETHYLBENZIDINE	119937		9.20E+000 H				7.3E-003 C	6.8E-004 C	3.4E-004 C	6.2E-001 C	6.9E-002 C
1,1-DIMETHYLHYDRAZINE	57147		2.60E+000 W		3.50E+000 W		2.6E-002 C	1.8E-003 C	1.2E-003 C	2.2E+000 C	2.5E-001 C
1,2-DIMETHYLHYDRAZINE	540738		3.70E+001 W		3.70E+001 W		1.8E-003 C	1.7E-004 C	8.5E-005 C	1.5E-001 C	1.7E-002 C
2,4-DIMETHYLPHENOL	105679	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
2,6-DIMETHYLPHENOL	576261	6.00E-004 I					2.2E+001 N	2.2E+000 N	8.1E-001 N	1.2E+003 N	4.7E+001 N
3,4-DIMETHYLPHENOL	95658	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
DIMETHYLPHTHALATE	131113	1.00E+001 W					3.7E+005 N	3.7E+004 N	1.4E+004 N	2.0E+007 N	7.8E+005 N
1,2-DINITROBENZENE	528290	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
1,3-DINITROBENZENE	99650	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N
1,4-DINITROBENZENE	100254	4.00E-004 H					1.5E+001 N	1.5E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
4,6-DINITRO-O-CYCLOHEXYL PHENOL	131895	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
4,6-DINITRO-2-METHYLPHENOL	534521	1.00E-004 E					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N
2,4-DINITROPHENOL	51285	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
DINITROTOLUENE MIX			6.80E-001 I				9.8E-002 C	9.2E-003 C	4.6E-003 C	8.4E+000 C	9.4E-001 C
2,4-DINITROTOLUENE	121142	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
2,6-DINITROTOLUENE	606202	1.00E-003 H					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
DINOSEB	88857	1.00E-003 I				y	6.1E+000 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
DIOCTYLPHTHALATE	117840	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
1,4-DIOXANE	123911		1.10E-002 I				6.1E+000 C	5.7E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C
DIPHENYLAMINE	122394	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N
1,2-DIPHENYLHYDRAZINE	122667		8.00E-001 I		8.00E-001 I		8.4E-002 C	7.8E-003 C	3.9E-003 C	7.2E+000 C	8.0E-001 C
DIQUAT	85007	2.20E-003 I					8.0E+001 N	8.0E+000 N	3.0E+000 N	4.5E+003 N	1.7E+002 N
DISULFOTON	298044	4.00E-005 I				y	2.4E-001 N	1.5E-001 N	6.4E-002 N	8.2E+001 N	3.1E+000 N
1,4-DITHIANE	505293	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
DIURON	330541	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
ENDOSULFAN	115297	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
ENDRIN	72208	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
EPICHLOROHYDRIN	106898	2.00E-003 H	9.90E-003 I	2.86E-004 I	4.20E-003 I		6.8E+000 C	1.0E+000 N	3.2E-001 C I	5.8E+002 C I	6.5E+001 C I
ETHION	563122	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N
2-ETHOXYETHANOL	110805	4.00E-001 H		5.70E-002 I			1.5E+004 N	2.1E+002 N	5.4E+002 N	8.2E+005 N	3.1E+004 N
ETHYL ACETATE	141786	9.00E-001 I				y	5.5E+003 N	3.3E+003 N	1.2E+003 N	1.8E+006 N	7.0E+004 N
ETHYLBENZENE	100414	1.00E-001 I		2.90E-001 I		y	1.3E+003 N	1.1E+003 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
ETHYLENE DIAMINE	107153	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
ETHYLENE GLYCOL	107211	2.00E+000 I					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
ETHYLENE GLYCOL, MONOBUTYL ETHER	111762			5.70E-003 H				2.1E+001 N			
ETHYLENE OXIDE	75218		1.00E+000 H		3.50E-001 H		6.7E-002 C	1.8E-002 C	3.2E-003 C	5.7E+000 C	6.4E-001 C
ETHYLENE THIOUREA	96457	8.00E-005 I	1.1E-001 H				6.1E-001 C I	5.7E-002 C I	2.9E-002 C I	5.2E+001 C I	5.8E+000 C I
ETHYL ETHER	60297	2.00E-001 I				y	1.2E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
ETHYL METHACRYLATE	97632	9.00E-002 H				y	5.5E+002 N	3.3E+002 N	1.2E+002 N	1.8E+005 N	7.0E+003 N
FENAMIPHOS	22224926	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N
FLUOMETURON	2164172	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N
FLUORINE	7782414	6.00E-002 I					2.2E+003 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N
FOMESAFEN	72178020		1.90E-001 I				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C
FONOFOS	944229	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
FORMALDEHYDE	50000	2.00E-001 I			4.50E-002 I		7.3E+003 N	1.4E-001 C	2.7E+002 N	4.1E+005 N	1.6E+004 N
FORMIC ACID	64186	2.00E+000 H					7.3E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
FURAN	110009	1.00E-003 I				y	6.1E+000 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
FURAZOLIDONE	67458		3.80E+000 H				1.8E-002 C	1.6E-003 C	8.3E-004 C	1.5E+000 C	1.7E-001 C
FURFURAL	98011	3.00E-003 I		1.00E-002 A			1.1E+002 N	3.7E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
GLYCIDALDEHYDE	765344	4.00E-004 I		2.90E-004 H			1.6E+001 N	1.1E+000 N	5.4E-001 N	8.2E+002 N	3.1E+001 N
GLYPHOSATE	1071836	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
HEPTACHLOR	76448	5.00E-004 I	4.50E+000 I		4.50E+000 I	y	2.3E-003 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C
HEPTACHLOR EPOXIDE	1024573	1.30E-005 I	9.10E+000 I		9.10E+000 I	y	1.2E-003 C	6.9E-004 C	3.5E-004 C	6.3E-001 C	7.0E-002 C
HEXABROMOBENZENE	87821	2.00E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
HEXACHLOROBENZENE	118741	8.00E-004 I	1.60E+000 I		1.60E+000 I	y	6.6E-003 C	3.9E-003 C	2.0E-003 C	3.6E+000 C	4.0E-001 C
HEXACHLOROBUTADIENE	87683	2.00E-004 H	7.80E-002 I		7.80E-002 I	y	1.4E-001 C I	8.0E-002 C I	4.0E-002 C I	7.3E+001 C I	8.2E+000 C I
ALPHA-HCH	319846		6.30E+000 I		6.30E+000 I		1.1E-002 C	9.9E-004 C	5.0E-004 C	9.1E-001 C	1.0E-001 C
BETA-HCH	319857		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C
GAMMA-HCH (LINDANE)	58899	3.00E-004 I	1.30E+000 H				5.2E-002 C	4.8E-003 C	2.4E-003 C	4.4E+000 C	4.9E-001 C
TECHNICAL HCH	608731		1.80E+000 I		1.80E+000 I		3.7E-002 C	3.5E-003 C	1.8E-003 C	3.2E+000 C	3.5E-001 C
HEXACHLOROCYCLOPENTADIENE	77474	7.00E-003 I		2.00E-005 H		y	1.5E-001 N	7.3E-002 N	9.5E+000 N	1.4E+004 N	5.5E+002 N
HEXACHLORODIBENZODIOXIN MIX	19408743		6.20E+003 I		4.55E+003 I		1.1E-005 C	1.4E-006 C	5.1E-007 C	9.2E-004 C	1.0E-004 C

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
HEXACHLOROETHANE	67721	1.00E-003 I	1.40E-002 I		1.40E-002 I	y	7.5E-001 C I	4.5E-001 C I	2.3E-001 C I	4.1E+002 C I	4.6E+001 C I
HEXACHLOROPHENE	70304	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
1,6-HEXAMETHYLENE DIISOCYANATE	822060			2.90E-006 I				1.1E-002 N			
HEXANE	110543	6.00E-002 H		5.71E-002 I		y	3.6E+002 N	2.1E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N
2-HEXANONE	591786	4.00E-002 E		1.4E-003 E			1.5E+003 N	5.1E+000 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
HEXAZINONE	51235042	3.30E-002 I					1.2E+003 N	1.2E+002 N	4.5E+001 N	6.7E+004 N	2.6E+003 N
HMX	2691410	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
HYDRAZINE	302012		3.00E+000 I		1.70E+001 I		2.2E-002 C	3.7E-004 C	1.1E-003 C	1.9E+000 C	2.1E-001 C
HYDROGEN CHLORIDE	7647010			5.70E-003 I				2.1E+001 N			
HYDROGEN SULFIDE	7783064	3.00E-003 I		2.85E-004 I			1.1E+002 N	1.0E+000 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
HYDROQUINONE	123319	4.00E-002 H					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
IRON	7439896	3.00E-001 E					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
ISOBUTANOL	78831	3.00E-001 I				y	1.8E+003 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
ISOPHORONE	78591	2.00E-001 I	9.50E-004 I				7.0E+001 C	6.6E+000 C	3.3E+000 C	6.0E+003 C	6.7E+002 C
ISOPROPALIN	33820530	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N
ISOPROPYL METHYL PHOSPHONIC ACID	1832548	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
TETRAETHYLLEAD	78002	1.00E-007 I				y	6.1E-004 N	3.7E-004 N	1.4E-004 N	2.0E-001 N	7.8E-003 N
LITHIUM	7439932	2.00E-002 E					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
MALATHION	121755	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
MALEIC ANHYDRIDE	108316	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
MANGANESE-NONFOOD	7439965	2.00E-002 I		1.43E-005 I			7.3E+002 N	5.2E-002 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
MANGANESE-FOOD	7439965	1.40E-001 I		1.43E-005 I			5.1E+003 N	5.2E-002 N	1.9E+002 N	2.9E+005 N	1.1E+004 N
MEPHOSFOLAN	950107	9.00E-005 H					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N
MEPIQUAT CHLORIDE	24307264	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
MERCURIC CHLORIDE	7487947	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
MERCURY (INORGANIC)	7439976			8.60E-005 I				3.1E-001 N			
METHYLMERCURY	22967926	1.00E-004 I					3.7E+000 N	3.7E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N
METHACRYLONITRILE	126987	1.00E-004 I		2.00E-004 A		y	1.0E+000 N	7.3E-001 N	1.4E-001 N	2.0E+002 N	7.8E+000 N
METHANOL	67561	5.00E-001 I					1.8E+004 N	1.8E+003 N	6.8E+002 N	1.0E+006 N	3.9E+004 N
METHIDATHION	950378	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
METHOXYCHLOR	72435	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
METHYL ACETATE	79209	1.00E+000 H				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
METHYL ACRYLATE	96333	3.00E-002 A				y	1.8E+002 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
2-METHYLANILINE	95534		2.40E-001 H				2.8E-001 C	2.6E-002 C	1.3E-002 C	2.4E+001 C	2.7E+000 C
4-(2-METHYL-4-CHLOROPHENOXY) BUTYRIC ACID	94815	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
2-METHYL-4-CHLOROPHENOXYACETIC ACID (MCPA)	94746	5.00E-004 I					1.8E+001 N	1.8E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N
2-(2-METHYL-4-CHLOROPHENOXY)PROPIONIC ACID (MCPI	93652	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
METHYLCYCLOHEXANE	108872			8.60E-001 H		y	6.3E+003 N	3.1E+003 N			
METHYLENE BROMIDE	74953	1.00E-002 A				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
METHYLENE CHLORIDE	75092	6.00E-002 I	7.50E-003 I	8.60E-001 H	1.65E-003 I	y	4.1E+000 C	3.8E+000 C	4.2E-001 C	7.6E+002 C	8.5E+001 C
4,4'-METHYLENE BIS(2-CHLOROANILINE)	101144	7.00E-004 H	1.30E-001 H		1.30E-001 H		5.2E-001 C	4.8E-002 C	2.4E-002 C	4.4E+001 C	4.9E+000 C
4,4'-METHYLENE BIS(N,N'-DIMETHYL)ANILINE	101611		4.60E-002 I				1.5E+000 C	1.4E-001 C	6.9E-002 C	1.2E+002 C	1.4E+001 C
4,4'-METHYLENEDIPHENYL ISOCYANATE	101688			1.7E-004 I				6.2E-001 N			
METHYL ETHYL KETONE (2-BUTANONE)	78933	6.00E-001 I		2.86E-001 I		y	1.9E+003 N	1.0E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N
METHYL HYDRAZINE	60344		1.10E+000 W				6.1E-002 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
METHYL ISOBUTYL KETONE (4-METHYL-2-PENTANONE)	108101	8.00E-002 H		2.00E-002 A			2.9E+003 N	7.3E+001 N	1.1E+002 N	1.6E+005 N	6.3E+003 N
METHYL METHACRYLATE	80626	1.40E+000 I		2.00E-001 I		y	1.4E+003 N	7.3E+002 N	1.9E+003 N	2.9E+006 N	1.1E+005 N
2-METHYL-5-NITROANILINE	99558		3.30E-002 H				2.0E+000 C	1.9E-001 C	9.6E-002 C	1.7E+002 C	1.9E+001 C
METHYL PARATHION	298000	2.50E-004 I					9.1E+000 N	9.1E-001 N	3.4E-001 N	5.1E+002 N	2.0E+001 N
2-METHYLPHENOL	95487	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
3-METHYLPHENOL	108394	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
4-METHYLPHENOL	106445	5.00E-003 H					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
METHYLSTYRENE MIX	25013154	6.00E-003 A		1.00E-002 A		y	5.5E+001 N	3.7E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
ALPHA-METHYLSTYRENE	98839	7.00E-002 A				y	4.3E+002 N	2.6E+002 N	9.6E+001 N	1.4E+005 N	5.5E+003 N
METHYL TERT-BUTYL ETHER	1634044			8.57E-001 I		y	6.3E+003 N	3.1E+003 N			
METOLACHLOR (DUAL)	51218452	1.50E-001 I					5.5E+003 N	5.5E+002 N	2.0E+002 N	3.1E+005 N	1.2E+004 N
MIREX	2385855	2.00E-004 I				y	1.2E+000 N	7.3E-001 N	2.7E-001 N	4.1E+002 N	1.6E+001 N
MOLYBDENUM	7439987	5E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
MONOCHLORAMINE	10599903	1E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
NALED	300765	2E-003 I					7.3E+001 N	7.3E+000 N	2.7E+000 N	4.1E+003 N	1.6E+002 N
NICKEL REFINERY DUST					8.4E-001 I			7.5E-003 C			
NICKEL	7440020	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
NITRATE	14797558	1.60E+000 I					5.8E+004 N	5.8E+003 N	2.2E+003 N	3.3E+006 N	1.3E+005 N
NITRIC OXIDE	10102439	1.00E-001 W				y	6.1E+002 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
NITRITE	14797650	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
2-NITROANILINE	88744			5.70E-005 H				2.1E-001 N			
**NITROBENZENE	98953	5.00E-004 I		6.00E-004 A		y	3.5E+000 N	2.2E+000 N	6.8E-001 N	1.0E+003 N	3.9E+001 N
NITROFURANTOIN	67209	7.00E-002 H					2.6E+003 N	2.6E+002 N	9.5E+001 N	1.4E+005 N	5.5E+003 N
NITROFURAZONE	59870		1.50E+000 H				4.5E-002 C	4.2E-003 C	2.1E-003 C	3.8E+000 C	4.3E-001 C
NITROGEN DIOXIDE	10102440	1.00E+000 W				y	6.1E+003 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
**NITROGLYCERIN	55630		1.4E-002 E				4.8E+000 C	4.5E-001 C	2.3E-001 C	4.1E+002 C	4.6E+001 C
4-NITROPHENOL	100027	8.00E-003 E					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N
**2-NITROPROPANE	79469			5.70E-003 I	9.40E+000 H	y	1.3E-003 C	6.7E-004 C			
N-NITROSO-DI-N-BUTYLAMINE	924163		5.40E+000 I		5.60E+000 I		1.2E-002 C	1.1E-003 C	5.8E-004 C	1.1E+000 C	1.2E-001 C
N-NITROSODIETHANOLAMINE	1116547		2.80E+000 I				2.4E-002 C	2.2E-003 C	1.1E-003 C	2.0E+000 C	2.3E-001 C
N-NITROSODIETHYLAMINE	55185		1.50E+002 I		1.50E+002 I		4.5E-004 C	4.2E-005 C	2.1E-005 C	3.8E-002 C	4.3E-003 C
N-NITROSODIMETHYLAMINE	62759		5.10E+001 I		5.10E+001 I		1.3E-003 C	1.2E-004 C	6.2E-005 C	1.1E-001 C	1.3E-002 C
N-NITROSODIPHENYLAMINE	86306		4.90E-003 I				1.4E+001 C	1.3E+000 C	6.4E-001 C	1.2E+003 C	1.3E+002 C
N-NITROSODIPROPYLAMINE	621647		7.00E+000 I				9.6E-003 C	8.9E-004 C	4.5E-004 C	8.2E-001 C	9.1E-002 C
N-NITROSO-N-ETHYLUREA	759739		1.40E+002 H				4.8E-004 C	4.5E-005 C	2.3E-005 C	4.1E-002 C	4.6E-003 C
N-NITROSO-N-METHYLETHYLAMINE	10595956		2.20E+001 I				3.0E-003 C	2.8E-004 C	1.4E-004 C	2.6E-001 C	2.9E-002 C
N-NITROSOPYRROLIDINE	930552		2.10E+000 I		2.10E+000 I		3.2E-002 C	3.0E-003 C	1.5E-003 C	2.7E+000 C	3.0E-001 C
M-NITROTOLUENE	99081	2.00E-002 E				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
O-NITROTOLUENE	88722	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
P-NITROTOLUENE	99990	1.00E-002 H				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
**NUSTAR	85509199	7.00E-004 I					2.6E+000 N	2.6E+000 N	9.5E-001 N	1.4E+003 N	5.5E+001 N
ORYZALIN	19044883	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
OXADIAZON	19666309	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
OXAMYL	23135220	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N
OXYFLUORFEN	42874033	3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

							Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
PARAQUAT DICHLORIDE	1910425	4.50E-003 I					1.6E+002 N	1.6E+001 N	6.1E+000 N	9.2E+003 N	3.5E+002 N
PARATHION	56382	6.00E-003 H					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
PENTACHLOROBENZENE	608935	8.00E-004 I				y	4.9E+000 N	2.9E+000 N	1.1E+000 N	1.6E+003 N	6.3E+001 N
PENTACHLORONITROBENZENE	82688	3.00E-003 I	2.60E-001 H			y	4.1E-002 C	2.4E-002 C	1.2E-002 C	2.2E+001 C	2.5E+000 C
PENTACHLOROPHENOL	87865	3.00E-002 I	1.20E-001 I				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C
PERMETHRIN	52645531	5.00E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
PHENOL	108952	6.00E-001 I					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N
M-PHENYLENEDIAMINE	108452	6.00E-003 I					2.2E+002 N	2.2E+001 N	8.1E+000 N	1.2E+004 N	4.7E+002 N
O-PHENYLENEDIAMINE	95545		4.70E-002 H				1.4E+000 C	1.3E-001 C	6.7E-002 C	1.2E+002 C	1.4E+001 C
P-PHENYLENEDIAMINE	106503	1.90E-001 H					6.9E+003 N	6.9E+002 N	2.6E+002 N	3.9E+005 N	1.5E+004 N
2-PHENYLPHENOL	90437		1.90E-003 H				3.5E+001 C	3.3E+000 C	1.7E+000 C	3.0E+003 C	3.4E+002 C
PHOSPHINE	7803512	3.00E-004 I		8.60E-005 I			1.1E+001 N	3.1E-001 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
PHOSPHORIC ACID	7664382			2.90E-003 I				1.1E+001 N			
PHOSPHORUS (WHITE)	7723140	2.00E-005 I					7.3E-001 N	7.3E-002 N	2.7E-002 N	4.1E+001 N	1.6E+000 N
P-PHTHALIC ACID	100210	1.00E+000 H					3.7E+004 N	3.7E+003 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
PHTHALIC ANHYDRIDE	85449	2.00E+000 I		3.43E-002 H			7.3E+004 N	1.3E+002 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
POLYBROMINATED BIPHENYLS		7.00E-006 H	8.90E+000 H				7.5E-003 C	7.0E-004 C	3.5E-004 C	6.4E-001 C	7.2E-002 C I
POLYCHLORINATED BIPHENYLS	1336363		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
AROCLOR-1016	12674112	7.00E-005 I	7.00E-002 I		7.00E-002 I		9.6E-001 C I	8.9E-002 C I	4.5E-002 C I	8.2E+001 C I	5.5E+000 N
AROCLOR-1221	11104282		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
AROCLOR-1232	11141165		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
AROCLOR-1242	53469219		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
AROCLOR-1248	12672296		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
AROCLOR-1254	11097691	2.00E-005 I	2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C I
AROCLOR-1260	11096825		2.00E+000 I		2.00E+000 I		3.3E-002 C	3.1E-003 C	1.6E-003 C	2.9E+000 C	3.2E-001 C
POLYCHLORINATED TERPHENYLS	61788338		4.50E+000 E				1.5E-002 C	1.4E-003 C	7.0E-004 C	1.3E+000 C	1.4E-001 C
POLYNUCLEAR AROMATIC HYDROCARBONS:											
ACENAPHTHENE	83329	6.00E-002 I					2.2E+003 N	2.2E+002 N	8.1E+001 N	1.2E+005 N	4.7E+003 N
ANTHRACENE	120127	3.00E-001 I					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
BENZ[A]ANTHRACENE	56553		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C
BENZO[B]FLUORANTHENE	205992		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C
BENZO[K]FLUORANTHENE	207089		7.30E-002 E				9.2E-001 C	8.6E-002 C	4.3E-002 C	7.8E+001 C	8.7E+000 C
BENZO[A]PYRENE	50328		7.30E+000 I		3.10E+000 E		9.2E-003 C	2.0E-003 C	4.3E-004 C	7.8E-001 C	8.7E-002 C
CARBAZOLE	86748		2.00E-002 H				3.3E+000 C	3.1E-001 C	1.6E-001 C	2.9E+002 C	3.2E+001 C
CHRYSENE	218019		7.30E-003 E				9.2E+000 C	8.6E-001 C	4.3E-001 C	7.8E+002 C	8.7E+001 C
DIBENZ[A,H]ANTHRACENE	53703		7.30E+000 E				9.2E-003 C	8.6E-004 C	4.3E-004 C	7.8E-001 C	8.7E-002 C
**DIBENZOFURAN	132649	4.00E-003 E				y	2.4E+001 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
FLUORANTHENE	206440	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
FLUORENE	86737	4.00E-002 I					1.5E+003 N	1.5E+002 N	5.4E+001 N	8.2E+004 N	3.1E+003 N
INDENO[1,2,3-C,D]PYRENE	193395		7.30E-001 E				9.2E-002 C	8.6E-003 C	4.3E-003 C	7.8E+000 C	8.7E-001 C
**2-METHYLNAPHTHALENE	91576	2.00E-002 O				y	1.2E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
**NAPHTHALENE	91203	2.00E-002 I		9.00E-004 I			7.3E+002 N	3.3E+000 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
PYRENE	129000	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
PROMETON	1610180	1.50E-002 I					5.5E+002 N	5.5E+001 N	2.0E+001 N	3.1E+004 N	1.2E+003 N
PROMETRYN	7287196	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N

(((

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST
E = EPA-NCEA provisional value O = other

Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c

Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Risk-based concentrations: Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Soil Residential mg/kg
PROPACHLOR	1918167	1.30E-002 I					4.7E+002 N	4.7E+001 N	1.8E+001 N	2.7E+004 N	1.0E+003 N
PROPANIL	709988	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
PROPARGITE	2312358	2.00E-002 I					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
N-PROPYLBENZENE		1.00E-002 E				y	6.1E+001 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
PROPYLENE GLYCOL	57556	2.00E+001 H					7.3E+005 N	7.3E+004 N	2.7E+004 N	4.1E+007 N	1.6E+006 N
PROPYLENE GLYCOL, MONOETHYL ETHER	52125538	7.00E-001 H					2.6E+004 N	2.6E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N
PROPYLENE GLYCOL, MONOMETHYL ETHER	107982	7.00E-001 H		5.70E-001 I			2.6E+004 N	2.1E+003 N	9.5E+002 N	1.4E+006 N	5.5E+004 N
PURSUIT	81335775	2.50E-001 I					9.1E+003 N	9.1E+002 N	3.4E+002 N	5.1E+005 N	2.0E+004 N
PYRIDINE	110861	1.00E-003 I					3.7E+001 N	3.7E+000 N	1.4E+000 N	2.0E+003 N	7.8E+001 N
QUINOLINE	91225		1.20E+001 H				5.6E-003 C	5.2E-004 C	2.6E-004 C	4.8E-001 C	5.3E-002 C
RDX	121824	3.00E-003 I	1.10E-001 I				6.1E-001 C	5.7E-002 C	2.9E-002 C	5.2E+001 C	5.8E+000 C
RESMETHRIN	10453868	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
**RONNEL	299843	5.00E-002 H				y	3.0E+002 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
ROTENONE	83794	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
SELENIOUS ACID	7783008	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
SELENIUM	7782492	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
SILVER	7440224	5.00E-003 I					1.8E+002 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
SIMAZINE	122349	5.00E-003 I	1.20E-001 H				5.6E-001 C	5.2E-002 C	2.6E-002 C	4.8E+001 C	5.3E+000 C
SODIUM AZIDE	26628228	4.00E-003 I					1.5E+002 N	1.5E+001 N	5.4E+000 N	8.2E+003 N	3.1E+002 N
SODIUM DIETHYLDITHIOCARBAMATE	148185	3.00E-002 I	2.70E-001 H				2.5E-001 C	2.3E-002 C	1.2E-002 C	2.1E+001 C	2.4E+000 C
STRONTIUM, STABLE	7440246	6.00E-001 I					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N
STRYCHNINE	57249	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
STYRENE	100425	2.00E-001 I		2.86E-001 I		y	1.6E+003 N	1.0E+003 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
2,3,7,8-TETRACHLORODIBENZODIOXIN	1746016		1.50E+005 H		1.50E+005 H		4.5E-007 C	4.2E-008 C	2.1E-008 C	3.8E-005 C	4.3E-006 C
1,2,4,5-TETRACHLOROBENZENE	95943	3.00E-004 I				y	1.8E+000 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
1,1,1,2-TETRACHLOROETHANE	630206	3.00E-002 I	2.60E-002 I		2.60E-002 I	y	4.1E-001 C	2.4E-001 C	1.2E-001 C	2.2E+002 C	2.5E+001 C
**1,1,2,2-TETRACHLOROETHANE	79345	6.00E-002 E	2.00E-001 I		2.00E-001 I	y	5.3E-002 C	3.1E-002 C	1.6E-002 C	2.9E+001 C	3.2E+000 C
TETRACHLOROETHENE	127184	1.00E-002 I	5.20E-002 E	1.4E-001 E	2.00E-003 E	y	1.1E+000 C	3.1E+000 C	6.1E-002 C	1.1E+002 C	1.2E+001 C
2,3,4,6-TETRACHLOROPHENOL	58902	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
P,A,A,A-TETRACHLOROTOLUENE	5216251		2.00E+001 H			y	5.3E-004 C	3.1E-004 C	1.6E-004 C	2.9E-001 C	3.2E-002 C
1,1,1,2-TETRAFLUOROETHANE	811972			2.29E+001 I		y	1.7E+005 N	8.4E+004 N			
TETRYL	479458	1.00E-002 H					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
THALLIC OXIDE	1314325	7.00E-005 W					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N
THALLIUM	7440280	7.00E-005 O					2.6E+000 N	2.6E-001 N	9.5E-002 N	1.4E+002 N	5.5E+000 N
THALLIUM ACETATE	563688	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N
THALLIUM CARBONATE	6533739	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N
THALLIUM CHLORIDE	7791120	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N
THALLIUM NITRATE	10102451	9.00E-005 I					3.3E+000 N	3.3E-001 N	1.2E-001 N	1.8E+002 N	7.0E+000 N
THALLIUM SULFATE (2:1)	7446186	8.00E-005 I					2.9E+000 N	2.9E-001 N	1.1E-001 N	1.6E+002 N	6.3E+000 N
THIOBENCARB	28249776	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
TIN	7440315	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N
TITANIUM	7440326	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N

Sources: I = IRIS H = HEAST A = HEAST Alternate W = Withdrawn from IRIS or HEAST E = EPA-NCEA provisional value O = other							Basis: C = Carcinogenic effects N = Noncarcinogenic effects I = RBC at HI of 0.1 < RBC-c Risk-based concentrations				
Chemical	CAS	RfDo mg/kg/d	CSFo 1/mg/kg/d	RfDi mg/kg/d	CSFi 1/mg/kg/d	VOC	Tap water ug/l	Ambient air ug/m3	Fish mg/kg	Soil Industrial mg/kg	Residential mg/kg
TITANIUM DIOXIDE	13463677	4.00E+000 E		8.60E-003 E			1.5E+005 N	3.1E+001 N	5.4E+003 N	8.2E+006 N	3.1E+005 N
TOLUENE	108883	2.00E-001 I		1.14E-001 I		y	7.5E+002 N	4.2E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
TOLUENE-2,4-DIAMINE	95807		3.20E+000 H				2.1E-002 C	2.0E-003 C	9.9E-004 C	1.8E+000 C	2.0E-001 C
TOLUENE-2,5-DIAMINE	95705	6.00E-001 H					2.2E+004 N	2.2E+003 N	8.1E+002 N	1.2E+006 N	4.7E+004 N
TOLUENE-2,6-DIAMINE	823405	2.00E-001 H					7.3E+003 N	7.3E+002 N	2.7E+002 N	4.1E+005 N	1.6E+004 N
P-TOLUIDINE	106490		1.90E-001 H				3.5E-001 C	3.3E-002 C	1.7E-002 C	3.0E+001 C	3.4E+000 C
**TOXAPHENE	8001352		1.10E+000 I		1.10E+000 I	y	9.6E-003 C	5.7E-003 C	2.9E-003 C	5.2E+000 C	5.8E-001 C
1,2,4-TRIBROMOBENZENE	615543	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
TRIBUTYLTIN OXIDE	56359	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
2,4,6-TRICHLOROANILINE	634935		3.40E-002 H				2.0E+000 C	1.8E-001 C	9.3E-002 C	1.7E+002 C	1.9E+001 C
1,2,4-TRICHLOROBENZENE	120821	1.00E-002 I		5.70E-002 H		y	1.9E+002 N	2.1E+002 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
1,1,1-TRICHLOROETHANE	71556	2.00E-002 E		2.86E-001 E		y	5.4E+002 N	1.0E+003 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
1,1,2-TRICHLOROETHANE	79005	4.00E-003 I	5.70E-002 I		5.60E-002 I	y	1.9E-001 C	1.1E-001 C	5.6E-002 C	1.0E+002 C	1.1E+001 C
TRICHLOROETHENE	79016	6.00E-003 E	1.10E-002 E		6.00E-003 E	y	1.6E+000 C	1.0E+000 C	2.9E-001 C	5.2E+002 C	5.8E+001 C I
TRICHLOROFLUOROMETHANE	75694	3.00E-001 I		2.00E-001 A		y	1.3E+003 N	7.3E+002 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
2,4,5-TRICHLOROPHENOL	95954	1.00E-001 I					3.7E+003 N	3.7E+002 N	1.4E+002 N	2.0E+005 N	7.8E+003 N
2,4,6-TRICHLOROPHENOL	88062		1.10E-002 I		1.00E-002 I		6.1E+000 C	6.3E-001 C	2.9E-001 C	5.2E+002 C	5.8E+001 C
2,4,5-T	93765	1.00E-002 I					3.7E+002 N	3.7E+001 N	1.4E+001 N	2.0E+004 N	7.8E+002 N
2-(2,4,5-TRICHLOROPHENOXY)PROPIONIC ACID	93721	8.00E-003 I					2.9E+002 N	2.9E+001 N	1.1E+001 N	1.6E+004 N	6.3E+002 N
1,1,2-TRICHLOROPROPANE	598776	5.00E-003 I				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
1,2,3-TRICHLOROPROPANE	96184	6.00E-003 I	7.00E+000 H			y	1.5E-003 C	8.9E-004 C	4.5E-004 C	8.2E-001 C	9.1E-002 C
1,2,3-TRICHLOROPROPENE	96195	5.00E-003 H				y	3.0E+001 N	1.8E+001 N	6.8E+000 N	1.0E+004 N	3.9E+002 N
1,1,2-TRICHLORO-1,2,2-TRIFLUOROETHANE	76131	3.00E+001 I		8.60E+000 H		y	5.9E+004 N	3.1E+004 N	4.1E+004 N	6.1E+007 N	2.3E+006 N
1,2,4-TRIMETHYLBENZENE	95636	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
1,3,5-TRIMETHYLBENZENE	108678	5.00E-002 E		1.70E-003 E		y	1.2E+001 N	6.2E+000 N	6.8E+001 N	1.0E+005 N	3.9E+003 N
TRIMETHYL PHOSPHATE	512561		3.70E-002 H				1.8E+000 C	1.7E-001 C	8.5E-002 C	1.5E+002 C	1.7E+001 C
1,3,5-TRINITROBENZENE	99354	3.00E-002 I					1.1E+003 N	1.1E+002 N	4.1E+001 N	6.1E+004 N	2.3E+003 N
2,4,6-TRINITROTOLUENE	118967	5.00E-004 I	3.00E-002 I				2.2E+000 C !	2.1E-001 C !	1.1E-001 C !	1.9E+002 C !	2.1E+001 C !
URANIUM (SOLUBLE SALTS)		3.00E-003 I					1.1E+002 N	1.1E+001 N	4.1E+000 N	6.1E+003 N	2.3E+002 N
VANADIUM	7440622	7.00E-003 H					2.6E+002 N	2.6E+001 N	9.5E+000 N	1.4E+004 N	5.5E+002 N
VANADIUM PENTOXIDE	1314621	9.00E-003 I					3.3E+002 N	3.3E+001 N	1.2E+001 N	1.8E+004 N	7.0E+002 N
VANADIUM SULFATE	16785812	2.00E-002 H					7.3E+002 N	7.3E+001 N	2.7E+001 N	4.1E+004 N	1.6E+003 N
VINCLOZOLIN	50471448	2.50E-002 I					9.1E+002 N	9.1E+001 N	3.4E+001 N	5.1E+004 N	2.0E+003 N
VINYL ACETATE	108054	1.00E+000 H		5.71E-002 I		y	4.1E+002 N	2.1E+002 N	1.4E+003 N	2.0E+006 N	7.8E+004 N
VINYL CHLORIDE	75014		1.90E+000 H		3.00E-001 H	y	1.9E-002 C	2.1E-002 C	1.7E-003 C	3.0E+000 C	3.4E-001 C
WARFARIN	81812	3.00E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
M-XYLENE	108383	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
O-XYLENE	95476	2.00E+000 H				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
P-XYLENE	106423					y					
XYLENES	1330207	2.00E+000 I				y	1.2E+004 N	7.3E+003 N	2.7E+003 N	4.1E+006 N	1.6E+005 N
ZINC	7440666	3.00E-001 I					1.1E+004 N	1.1E+003 N	4.1E+002 N	6.1E+005 N	2.3E+004 N
ZINC PHOSPHIDE	1314847	3E-004 I					1.1E+001 N	1.1E+000 N	4.1E-001 N	6.1E+002 N	2.3E+001 N
ZINEB	12122677	5E-002 I					1.8E+003 N	1.8E+002 N	6.8E+001 N	1.0E+005 N	3.9E+003 N

APPENDIX E

FEDERAL AMBIENT WATER QUALITY CRITERIA

federal register

Thursday
December 10, 1998

Part IV

Environmental Protection Agency

National Recommended Water Quality Criteria; Notice; Republication

ENVIRONMENTAL PROTECTION AGENCY

[FRL–OW–6186–6a]

National Recommended Water Quality Criteria; Republication

Editorial Note: FR Doc. 98-30272 was originally published as Part IV (63 FR 67548-67558) in the issue of Monday, December 7, 1998. At the request of the agency, due to incorrect footnote identifiers in the tables, the corrected document is being republished in its entirety.

AGENCY: Environmental Protection Agency (EPA).

ACTION: Compilation of recommended water quality criteria and notice of process for new and revised criteria.

SUMMARY: EPA is publishing a compilation of its national recommended water quality criteria for 157 pollutants, developed pursuant to section 304(a) of the Clean Water Act (CWA or the Act). These recommended criteria provide guidance for States and Tribes in adopting water quality standards under section 303(c) of the CWA. Such standards are used in implementing a number of environmental programs, including setting discharge limits in National Pollutant Discharge Elimination System (NPDES) permits. These water quality criteria are not regulations, and do not impose legally binding requirements on EPA, States, Tribes or the public.

This document also describes changes in EPA's process for deriving new and revised 304(a) criteria. Comments provided to the Agency about the content of this Notice will be considered in future publications of water quality criteria and in carrying out the process for deriving water quality criteria. With this improved process the public will have more opportunity to provide data and views for consideration by EPA. The public may send any comments or observations regarding the compilation format or the process for deriving new or revised water quality criteria to the Agency now, or anytime while the process is being implemented.

ADDRESSES: A copy of the document, "National Recommended Water Quality Criteria" is available from the U.S. EPA, National Center for Environmental Publications and Information, 11029 Kenwood Road, Cincinnati, Ohio 45242, phone (513) 489–8190. The publication is also available electronically at: http://www.epa.gov/ost. Send an original and 3 copies of written comments to W-98-24 Comment Clerk, Water Docket, MC 4104, US EPA, 401 M Street, S.W., Washington, D.C. 20460. Comments may also be submitted electronically to OW-Docket@epamail.epa.gov. Comments should be submitted as a WP5.1, 6.1 or an ASCII file with no form of encryption. The documents cited in the compilation of recommended criteria are available for inspection from 9 to 4 p.m., Monday through Friday, excluding legal holidays, at the Water Docket, EB57, East Tower Basement, USEPA, 401 M St., S.W., Washington, D.C. 20460. For access to these materials, please call (202) 260–3027 to schedule an appointment.

FOR FURTHER INFORMATION CONTACT: Cindy A. Roberts, Health and Ecological Criteria Division (4304), U.S. EPA, 401 M. Street, S.W., Washington, D.C. 20460; (202) 260–2787; roberts.cindy@epamail.epa.gov.

SUPPLEMENTARY INFORMATION:

I. What Are Water Quality Criteria?

Section 304(a)(1) of the Clean Water Act requires EPA to develop and publish, and from time to time revise, criteria for water quality accurately reflecting the latest scientific knowledge. Water quality criteria developed under section 304(a) are based solely on data and scientific judgments on the relationship between pollutant concentrations and environmental and human health effects. Section 304(a) criteria do not reflect consideration of economic impacts or the technological feasibility of meeting the chemical concentrations in ambient water. Section 304(a) criteria provide guidance to States and Tribes in adopting water quality standards that ultimately provide a basis for controlling discharges or releases of pollutants. The criteria also provide guidance to EPA when promulgating federal regulations under section 303(c) when such action is necessary.

II. What is in the Compilation Published Today?

EPA is today publishing a compilation of its national recommended water quality criteria for 157 pollutants. This compilation is also available in hard copy at the address given above.

The compilation is presented as a summary table containing EPA's water quality criteria for 147 pollutants, and for an additional 10 pollutants, criteria solely for organoleptic effects. For each set of criteria, EPA lists a **Federal Register** citation, EPA document number or Integrated Risk Information System (IRIS) entry (www.epa.gov/ngispgm3/iris/irisdat). Specific information pertinent to the derivation of individual criteria may be found in cited references. If no criteria are listed for a pollutant, EPA does not have any national recommended water quality criteria.

These water quality criteria are the Agency's current recommended 304(a) criteria, reflecting the latest scientific knowledge. They are generally applicable to the waters of the United States. EPA recommends that States and Tribes use these water quality criteria as guidance in adopting water quality standards pursuant to section 303(c) of the Act and the implementing of federal regulations at 40 CFR part 131. Water quality criteria derived to address site-specific situations are not included; EPA recommends that States and Tribes follow EPA's technical guidance in the "Water Quality Standards Handbook—2nd Edition," EPA, August 1994, in deriving such site-specific criteria. EPA recognizes that in limited circumstances there may be regulatory voids in the absence of State or Tribal water quality standards for specific pollutants. However, States and Tribes should utilize the existing State and Tribal narrative criteria to address such situations; States and Tribes may consult EPA criteria documents and cites in the summary table for additional information.

The national recommended water quality criteria include: previously published criteria that are unchanged; criteria that have been recalculated from earlier criteria; and newly calculated criteria, based on peer-reviewed assessments, methodologies and data, that have not been previously published.

The information used to calculate the water quality criteria is not included in the summary table. Most information has been previously published by the Agency in a variety of sources, and the summary table cites those sources.

When using these 304(a) criteria as guidance in adopting water quality standards, EPA recommends States and Tribes consult the citations referenced in the summary table for additional information regarding the derivation of individual criteria.

The Agency intends to revise the compilation of national recommended water quality criteria from time to time to keep States and Tribes informed as to the most current recommended water quality criteria.

III. How Are National Recommended Water Quality Criteria Used?

Once new or revised 304(a) criteria are published by EPA, the Agency expects States and Tribes to adopt promptly new or revised numeric water quality criteria into their standards consistent with one of the three options in 40 CFR 131.11. These options are: (1) Adopt the recommended section 304(a) criteria; (2) adopt section 304(a) criteria modified to reflect site-specific conditions; or, (3) adopt criteria derived using other scientifically defensible methods. In adopting criteria under option (2) or (3), States and Tribes must adopt water quality criteria sufficient to protect the designated uses of their waters. When establishing a numerical value based on 304(a) criteria, States and Tribes may reflect site specific conditions or use other scientifically defensible methods. However, States and Tribes should not selectively apply data or selectively use endpoints, species, risk levels, or exposure parameters in deriving criteria; this would not accurately characterize risk and would not result in criteria protective of designated uses.

EPA emphasizes that, in the course of carrying out its responsibilities under section 303(c), it reviews State and Tribal water quality standards to assess the need for new or revised water quality criteria. EPA generally believes that five years from the date of EPA's publication of new or revised water quality criteria is a reasonable time by which States and Tribes should take action to adopt new or revised water quality criteria necessary to protect the designated uses of their waters. This period is intended to accommodate those States and Tribes that have begun a triennial review and wish to complete the actions they have underway, deferring initiating adoption of new or revised section 304(a) criteria until the next triennial review.

IV. What is the Status of Existing Criteria While They Are Under Revision?

The question of the status of the existing section 304(a) criteria often arises when EPA announces that it is beginning a reassessment of existing criteria. The general answer is that water quality criteria published by EPA remain the Agency's recommended water quality criteria until EPA revises or withdraws the criteria. For example, while undertaking recent reassessments of dioxin, PCBs, and other chemicals, EPA has consistently upheld the use of the current section 304(a) criteria for these chemicals and considers them to be scientifically sound until new, peer reviewed, scientific assessments indicate changes are needed. Therefore, the criteria in today's notice are and will continue to be the Agency's national recommended water quality criteria for States and Tribes to use in adopting or revising their water quality standards until superseded by the publication of revised criteria, or withdrawn by notice in the **Federal Register**.

V. What is the Process for Developing New or Revised Criteria?

Section 304(a)(1) of the CWA requires the Agency to develop and publish, and from time to time revise, criteria for water quality accurately reflecting the latest scientific knowledge. The Agency has developed an improved process that it intends to use when deriving new criteria or conducting a major reassessment of existing criteria. The purpose of the improved process is to provide expanded opportunities for public input, and to make the process more efficient.

When deriving new criteria, or when initiating a major reassessment of existing criteria, EPA will take the following steps.

1. EPA will first undertake a comprehensive review of available data and information.

2. EPA will publish a notice in the **Federal Register** and on the Internet announcing its assessment or reassessment of the pollutant. The notice will describe the data available to the Agency, and will solicit any additional pertinent data or views that may be useful in deriving new or revised criteria. EPA is especially interested in hearing from the public regarding new data or information that was unavailable to the Agency, and scientific views as to the application of the relevant Agency methodology for deriving water quality criteria.

3. After public input is received and evaluated, EPA will then utilize information obtained from both the Agency's literature review and the public to develop draft recommended water quality criteria.

4. EPA will initiate a peer review of the draft criteria. Agency peer review consists of a documented critical review by qualified independent experts. Information about EPA peer review practices may be found in the Science Policy Council's Peer Review Handbook (EPA 100-B-98-001, www.epa.gov).

5. Concurrent with the peer review in step four, EPA will publish a notice in the **Federal Register** and on the Internet, of the availability of the draft water quality criteria and solicit views from the public on issues of science pertaining to the information used in deriving the draft criteria. The Agency believes it is important to provide the public with the opportunity to provide scientific views on the draft criteria even though we are not required to invite and respond to written comments.

6. EPA will evaluate the results of the peer review, and prepare a response document for the record in accordance with EPA's Peer Review Handbook. EPA at the same time will consider views provided by the public on issues of science. Major scientific issues will be addressed in the record whether from the peer review or the public.

7. EPA will then revise the draft criteria as necessary, and announce the availability of the final water quality criteria in the **Federal Register** and on the Internet.

VI. What is the Process for Minor Revisions to Criteria?

In addition to developing new criteria, and conducting major reassessments of existing criteria, EPA also from time to time recalculates criteria based on new information pertaining to individual components of the criteria. For example, in today's notice, EPA has recalculated a number of criteria based on new, peer-reviewed data contained in EPA's IRIS. Because such recalculations normally result in only minor changes to the criteria, do not ordinarily involve a change in the underlying scientific methodologies, and reflect peer-reviewed data, EPA will typically publish such recalculated criteria directly as the Agency's recommended water quality criteria. If it appears that a recalculation results in a significant change EPA will follow the process of peer review and public input outlined above. Further, when EPA recalculates national water quality criteria in the course of proposing or promulgating state-specific federal water quality standards pursuant to section 303(c), EPA will offer an opportunity for national public input on the recalculated criteria.

VII. How Does the Process Outlined Above Improve Public Input and Efficiency?

In the past, EPA developed draft criteria documents and announced their availability for public comment in the **Federal Register**. This led to new data and views coming to EPA's attention after draft criteria had already been developed. Responding to new data would sometimes lead to extensive revisions.

The steps outlined above improve the criteria development process in the following ways.

1. The new process is Internet-based which is in line with EPA policy for public access and dissemination of information gathered by EPA. Use of the Internet will allow the public to be more engaged in the criteria development process than previously and to more

knowledgeably follow criteria development. For new criteria or major revisions, EPA will announce its intentions to derive the new or revised criteria on the Internet and include a list of the available literature. This will give the public an opportunity to provide additional data that might not otherwise be identified by the Agency.

2. The public now has two opportunities to contribute data and views, before development and during development, instead of a single opportunity after development.

3. EPA has instituted broader and more formal peer review procedures. This independent scientific review is a more rigorous disciplinary practice to ensure technical improvements in Agency decision making. Previously, EPA used the public comment process outlined above to obtain peer review. The new process allows for both public input and a formal peer review, resulting in a more thorough and complete evaluation of the criteria.

4. Announcing the availability of the draft water quality criteria on the Internet will give the public an opportunity to provide input on issues of science in a more timely manner.

VIII. Where Can I Find More Information About Water Quality Criteria and Water Quality Standards?

For more information about water quality criteria and Water Quality Standards refer to the following: Water Quality Standards Handbook (EPA 823-B94-005a); Advanced Notice of Proposed Rule Making (ANPRM), (63 FR 36742); Water Quality Criteria and Standards Plan—Priorities for the Future (EPA 822-R-98-003); Guidelines and Methodologies Used in the Preparation of Health Effects Assessment Chapters of the Consent Decree Water Criteria Documents (45 FR 79347); Draft Water Quality Criteria Methodology Revisions: Human Health (63 FR 43755, EPA 822-Z-98-001); and Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses (EPA 822/R-85-100); National Strategy for the Development of Regional Nutrient Criteria (EPA 822-R-98-002).

These publications may also be accessed through EPA's National Center for Environmental Publications and Information (NCEPI) or on the Office of Science and Technology's Home-page (www.epa.gov/OST).

IX. What Are the National Recommended Water Quality Criteria?

The following compilation and its associated footnotes and notes presents the national recommended water quality criteria.

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR PRIORITY TOXIC POLLUTANTS

Priority pollutant	CAS No.	Freshwater		Saltwater		Human health for consumption of:		FR cite/source
		CMC (µg/L)	CCC (µg/L)	CMC (µg/L)	CCC (µg/L)	Water + organism (µg/L)	Organism only (µg/L)	
1 Antimony	7440360					14[B,Z]	4300[B]	57 FR 60848
2 Arsenic	7440382	340[A,D,K]	150[A,D,K]	69[A,D,bb]	36[A,D,bb]			62 FR 42160
						0.018[C,M,S]	0.14[C,M,S]	57 FR 60848
3 Beryllium	7440417					[J,Z]	[J]	62 FR 42160
4 Cadmium	7440439	4.3[D,E,K]	2.2[D,E,K]	42[D,bb]	9.3[D,bb]	[J,Z]	[J]	62 FR 42160
5a Chromium III	16065831	570[D,E,K]	74[D,E,K]					EPA 820/B–96–001
						[J,Z Total]	[J]	62 FR 42160
5b Chromium VI	18540299	16[D,K]	11[D,K]	1,100[D,bb]	50[D,bb]	[J,Z Total]	[J]	62 FR 42160
6 Copper	7440508	13[D,E,K,cc]	9.0[D,E,K,cc]	4.8[D,cc,ff]	3.1[D,cc,ff]	1,300[U]		62 FR 42160
7 Lead	7439921	65[D,E,bb,gg]	2.5[D,E,bb,gg]	210[D,bb]	8.1[D,bb]	[J]	[J]	62 FR 42160
8 Mercury	7439976	1.4[D,K,hh]	0.77[D,K,hh]	1.8[D,ee,hh]	0.94[D,ee,hh]	0.050[B]	0.051[B]	62 FR 42160
9 Nickel	7440020	470[D,E,K]	52[D,E,K]	74[D,bb]	8.2[D,bb]	610[B]	4,600[B]	62 FR 42160
10 Selenium	7782492	[L,R,T]	5.0[T]	290[D,bb,dd]	71[D,bb,dd]			62 FR 42160
						170[Z]	11,000	IRIS 09/01/91
11 Silver	7440224	3.4[D,E,G]		1.9[D,G]				62 FR 42160
12 Thallium	7440280					1.7[B]	6.3[B]	57 FR 60848
13 Zinc	7440666	120[D,E,K]	120[D,E,K]	90[D,bb]	81[D,bb]			62 FR 42160
						9,100[U]	69,000[U]	IRIS 10/01/92
14 Cyanide	57125	22[K,Q]	5.2[K,Q]					EPA 820/B–96–001
				1[Q,bb]	1[Q,bb]	700[B,Z]	220,000[B,H]	57 FR 60848
15 Asbestos	1332214					7 million fibers/L[I]		57 FR 60848
16 2, 3, 7, 8-TCDD Dioxin	1746016					1.3E–8[C]	1.4E–8[C]	62 FR 42160
17 Acrolein	107028					320	780	57 FR 60848
18 Acrylonitrile	107131					0.059[B,C]	0.66[B,C]	57 FR 60848
19 Benzene	71432					1.2[B,C]	71[B,C]	62 FR 42160
20 Bromoform	75252					4.3[B,C]	360[B,C]	62 FR 42160
21 Carbon Tetrachloride	56235					0.25[B,C]	4.4[B,C]	57 FR 60848
22 Chlorobenzene	108907					680[B,Z]	21,000[B,H]	57 FR 60848
23 Chlorodibromomethane	124481					0.41[B,C]	34[B,C]	62 FR 42160
24 Chloroethane	75003							
25 2-Chloroethylvinyl Ether	110758							
26 Chloroform	67663					5.7[B,C]	470[B,C]	62 FR 42160
27 Dichlorobromomethane	75274					0.56[B,C]	46[B,C]	62 FR 42160
28 1,1-Dichloroethane	75343							
29 1,2-Dichloroethane	107062					0.38[B,C]	99[B,C]	57 FR 60848
30 1,1-Dichloroethylene	75354					0.057[B,C]	3.2[B,C]	57 FR 60848
31 1,2-Dichloropropane	78875					0.52[B,C]	39[B,C]	62 FR 42160
32 1,3-Dichloropropene	542756					10[B]	1,700[B]	57 FR 60848
33 Ethylbenzene	100414					3,100[B,Z]	29,000[B]	62 FR 42160
34 Methyl Bromide	74839					48[B]	4000[B]	62 FR 42160
35 Methyl Chloride	74873					[J]	[J]	62 FR 42160
36 Methylene Chloride	75092					4.7[B,C]	1600[B,C]	62 FR 42160
37 1,1,2,2-Tetrachloroethane	79345					0.17[B,C]	11[B,C]	57 FR 60848
38 Tetrachloroethylene	127184					0.8[C]	8.85[C]	57 FR 60848
39 Toluene	108883					6,800[B,Z]	200,000[B]	62 FR 42160
40 1,2-Trans-Dichloroethylene	156605					700[B,Z]	140,000[B]	62 FR 42160
41 1,1,1-Trichloroethane	71556					[J,Z]	[J]	62 FR 42160
42 1,1,2-Trichloroethane	79005					0.60[B,C]	42[B,C]	57 FR 60848
43 Trichloroethylene	79016					2.7[C]	81[C]	57 FR 60848
44 Vinyl Chloride	75014					2.0[C]	525[C]	57 FR 60848
45 2-Chlorophenol	95578					120[B,U]	400[B,U]	62 FR 42160
46 2,4-Dichlorophenol	120832					93[B,U]	790[B,U]	57 FR 60848
47 2,4-Dimethylphenol	105679					540[B,U]	2,300[B,U]	62 FR 42160
48 2-Methyl-4,6-Dinitrophenol	534521					13.4	765	57 FR 60848
49 2,4-Dinitrophenol	51285					70[B]	14,000[B]	57 FR 60848
50 2-Nitrophenol	88755							
51 4-Nitrophenol	100027							
52 3-Methyl-4-Chlorophenol	59507					[U]	[U]	

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR PRIORITY TOXIC POLLUTANTS—Continued

	Priority pollutant	CAS No.	Freshwater		Saltwater		Human health for consumption of:		FR cite/source
			CMC (µg/L)	CCC (µg/L)	CMC (µg/L)	CCC (µg/L)	Water + organism (µg/L)	Organism only (µg/L)	
53	Pentachlorophenol	87865	19[F,K]	15[F,K]	13[bb]	7.9[bb]	0.28[B,C]	8.2[B,C,H]	62 FR 42160
54	Phenol	108952					21,000[B,U]		62 FR 42160
								4,600,000[B,H,U]	57 FR 60848
55	2,4,6-Trichlorophenol	88062					2.1[B,C,U]	6.5[B,C]	62 FR 42160
56	Acenaphthene	83329					1,200[B,U]	2,700[B,U]	62 FR 42160
57	Acenaphthylene	208968							
58	Anthracene	120127					9,600[B]	110,000[B]	62 FR 42160
59	Benzidine	92875					0.00012[B,C]	0.00054[B,C]	57 FR 60848
60	BenzoaAnthracene	56553					0.0044[B,C]	0.049[B,C]	62 FR 42160
61	BenzoaPyrene	50328					0.0044[B,C]	0.049[B,C]	62 FR 42160
62	BenzobFluoranthene	205992					0.0044[B,C]	0.049[B,C]	62 FR 42160
63	BenzoghiPerylene	191242							
64	BenzokFluoranthene	207089					0.0044[B,C]	0.049[B,C]	62 FR 42160
65	Bis2-ChloroethoxyMethane	111911							
66	Bis2-ChloroethylEther	111444					0.031[B,C]	1.4[B,C]	57 FR 60848
67	Bis2-ChloroisopropylEther	39638329					1,400[B]		62 FR 42160
								170,000[B]	57 FR 60848
68	Bis2-EthylhexylPhthalate[X]	117817					1.8[B,C]	5.9[B,C]	57 FR 60848
69	4-Bromophenyl Phenyl Ether	101553							
70	Butylbenzyl Phthalate[W]	85687					3,000[B]	5,200[B]	62 FR 42160
71	2-Chloronaphthalene	91587					1,700[B]	4,300[B]	62 FR 42160
72	4-Chlorophenyl Phenyl Ether	7005723							
73	Chrysene	218019					0.0044[B,C]	0.049[B,C]	62 FR 42160
74	Dibenzoa,hAnthracene	53703					0.0044[B,C]	0.049[B,C]	62 FR 42160
75	1,2-Dichlorobenzene	95501					2,700[B,Z]	17,000[B]	62 FR 42160
76	1,3-Dichlorobenzene	541731					400	2,600	62 FR 42160
77	1,4-Dichlorobenzene	106467					400[Z]	2,600	62 FR 42160
78	3,3′-Dichlorobenzidine	91941					0.04[B,C]	0.077[B,C]	57 FR 60848
79	Diethyl Phthalate[W]	84662					23,000[B]	120,000[B]	57 FR 60848
80	Dimethyl Phthalate[W]	131113					313,000	2,900,000	57 FR 60848
81	Di-n-Butyl Phthalate[W]	84742					2,700[B]	12,000[B]	57 FR 60848
82	2,4-Dinitrotoluene	121142					0.11[C]	9.1[C]	57 FR 60848
83	2,6-Dinitrotoluene	606202							
84	Di-n-Octyl Phthalate	117840							
85	1,2-Diphenylhydrazine	122667					0.040[B,C]	0.54[B,C]	57 FR 60848
86	Fluoranthene	206440					300[B]	370[B]	62 FR 42160
87	Fluorene	86737					1,300[B]	14,000[B]	62 FR 42160
88	Hexachlorobenzene	118741					0.00075[B,C]	0.00077[B,C]	62 FR 42160
89	Hexachlorobutadiene	87683					0.44[B,C]	50[B,C]	57 FR 60848
90	Hexachlorocyclopentadiene	77474					240[B,U,Z]	17,000[B,H,U]	57 FR 60848
91	Hexachloroethane	67721					1.9[B,C]	8.9[B,C]	57 FR 60848
92	Ideno 1,2,3-cdPyrene	193395					0.0044[B,C]	0.049[B,C]	62 FR 42160
93	Isophorone	78591					36[B,C]	2,600[B,C]	IRIS 11/01/97
94	Naphthalene	91203							
95	Nitrobenzene	98953					17[B]	1,900[B,H,U]	57 FR 60848
96	N-Nitrosodimethylamine	62759					0.00069[B,C]	8.1[B,C]	57 FR 60848
97	N-Nitrosodi-n-Propylamine	621647					0.005[B,C]	1.4[B,C]	62 FR 42160
98	N-Nitrosodiphenylamine	86306					5.0[B,C]	16[B,C]	57 FR 60848
99	Phenanthrene	85018							
100	Pyrene	129000					960[B]	11,000[B]	62 FR 42160
101	1,2,4-Trichlorobenzene	120821					260[Z]	940	IRIS 11/01/96
102	Aldrin	309002	3.0[G]		1.3[G]		0.00013[B,C]	0.00014[B,C]	62 FR 42160
103	alpha-BHC	319846					0.0039[B,C]	0.013[B,C]	62 FR 42160
104	beta-BHC	319857					0.014[B,C]	0.046[B,C]	62 FR 42160
105	gamma-BHC (Lindane)	58899	0.95[K]		0.16[G]		0.019[C]	0.063[C]	62 FR 42160
106	delta-BHC	319868							
107	Chlordane	57749	2.4[G]	0.0043[G,aa]	0.09[G]	0.004[G,aa]			62 FR 42160
							0.0021[B,C]	0.0022[B,C]	IRIS 02/07/98

108 4,4'-DDT	50293	1.1 [G]	0.001 [G,aa]	0.13 [G]	0.001 [G,aa]	0.00059 [B,C]	0.00059 [B,C]	62 FR 42160
109 4,4'-DDE	72559					0.00059 [B,C]	0.00059 [B,C]	62 FR 42160
110 4,4'-DDD	72548					0.00083 [B,C]	0.00084 [B,C]	62 FR 42160
111 Dieldrin	60571	0.24 [K]	0.056 [K,O]	0.71 [G]	0.0019 [G,aa]	0.00014 [B,C]	0.00014 [B,C]	62 FR 42160
112 alpha-Endosulfan	959988	0.22 [G,Y]	0.056 [G,Y]	0.034 [G,Y]	0.0087 [G,Y]	110 [B]	240 [B]	62 FR 42160
113 beta-Endosulfan	33213659	0.22 [G,Y]	0.056 [G,Y]	0.034 [G,Y]	0.0087 [G,Y]	110 [B]	240 [B]	62 FR 42160
114 Endosulfan Sulfate	1031078					110 [B]	240 [B]	62 FR 42160
115 Endrin	72208	0.086 [K]	0.036 [K,O]	0.037 [G]	0.0023 [G,aa]	0.76 [B]	0.81 [B,H]	62 FR 42160
116 Endrin Aldehyde	7421934					0.76 [B]	0.81 [B,H]	62 FR 42160
117 Heptachlor	76448	0.52 [G]	0.0038 [G,aa]	0.053 [G]	0.0036 [G,aa]	0.00021 [B,C]	0.00021 [B,C]	62 FR 42160
118 Heptachlor Epoxide	1024573	0.52 [G,V]	0.0038 [G,V,aa]	0.053 [G,V]	0.0036 [G,V,aa]	0.00010 [B,C]	0.00011 [B,C]	62 FR 42160
119 Polychlorinated Biphenyls			0.014 [N,aa]		0.03 [N,aa]			62 FR 42160
PCBs						0.00017 [B,C,P]	0.00017 [B,C,P]	63 FR 16182
120 Toxaphene	8001352	0.73	0.0002 [aa]	0.21	0.0002 [aa]	0.00073 [B,C]	0.00075 [B,C]	62 FR 42160

Footnotes:

[A] This recommended water quality criterion was derived from data for arsenic (III), but is applied here to total arsenic, which might imply that arsenic (III) and arsenic (V) are equally toxic to aquatic life and that their toxicities are additive. In the arsenic criteria document (EPA 440/5–84–033, January 1985), Species Mean Acute Values are given for both arsenic (III) and arsenic (V) for five species and the ratios of the SMAVs for each species range from 0.6 to 1.7. Chronic values are available for both arsenic (III) and arsenic (V) for one species; for the fathead minnow, the chronic value for arsenic (V) is 0.29 times the chronic value for arsenic (III). No data are known to be available concerning whether the toxicities of the forms of arsenic to aquatic organisms are additive.

[B] This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of April 8, 1998. The fish tissue bioconcentration factor (BCF) from the 1980 Ambient Water Quality Criteria document was retained in each case.

[C] This criterion is based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10^{-5}, move the decimal point in the recommended criterion one place to the right).

[D] Freshwater and saltwater criteria for metals are expressed in terms of the dissolved metal in the water column. The recommended water quality criteria value was calculated by using the previous 304(a) aquatic life criteria expressed in terms of total recoverable metal, and multiplying it by a conversion factor (CF). The term "Conversion Factor" (CF) represents the recommended conversion factor for converting a metal criterion expressed as the total recoverable fraction in the water column to a criterion expressed as the dissolved fraction in the water column. (Conversion Factors for saltwater CCCs are not currently available. Conversion factors derived for saltwater CMCs have been used for both saltwater CMCs and CCCs.) See "Office of Water Policy and Technical Guidance on Interpretation and Implementation of Aquatic Life Metals Criteria," October 1, 1993, by Martha G. Prothro, Acting Assistant Administrator for Water, available from the Water Resource center, USEPA, 401 M St., SW, mail code RC4100, Washington, DC 20460; and 40 CFR§ 131.36(b)(1). Conversion Factors applied in the table can be found in Appendix A to the Preamble—Conversion Factors for Dissolved Metals.

[E] The freshwater criterion for this metal is expressed as a function of hardness (mg/L) in the water column. The value given here corresponds to a hardness of 100 mg/L. Criteria values for other hardness may be calculated from the following: CMC (dissolved) = exp $\{m_A [\ln(\text{hardness})]+b_A\}$ (CF), or CCC (dissolved) = exp $\{m_C [\ln (\text{hardness})]+b_C\}$ (CF) and the parameters specified in Appendix B to the Preamble—Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent.

[F] Freshwater aquatic life values for pentachlorophenol are expressed as a function of pH, and are calculated as follows: CMD=exp(1.005(pH) − 4.869); CCC=exp(1.005 (pH) − 5.134). Values displayed in table correspond to a pH of 7.8.

[G] This Criterion is based on 304(a) aquatic life criterion issued in 1980, and was issued in one of the following documents: Aldrin/Dieldrin (EPA 440/5–80–019), Chlordane (EPA 440/5–80–027), DDT (EPA 440/5–80–038), Endosulfan (EPA 440/5–80–046), Endrin (EPA 440/5–80–047), Heptachlor (440/5–80–052), Hexachlorocyclohexane (EPA 440/5–80–054), Silver (EPA 440/5–80–071). The Minimum Data Requirements and derivation procedures were different in the 1980 Guidelines than in the 1985 Guidelines. For example, a "CMC" derived using the 1980 Guidelines was derived to be used as an instantaneous maximum. If assessment is to be done using an averaging period, the values given should be divided by 2 to obtain a value that is more comparable to a CMC derived using the 1985 Guidelines.

[H] No criterion for protection of human health from consumption of aquatic organisms excluding water was presented in the 1980 criteria document or in the 1986 Quality Criteria for Water. Nevertheless, sufficient information was presented in the 1980 document to allow the calculation of a criterion, even though the results of such a calculation were not shown in the document.

[I] This criterion for asbestos is the Maximum Contaminant Level (MCL) developed under the Safe Drinking Water Act (SDWA).

[J] EPA has not calculated human health criterion for this contaminant. However, permit authorities should address this contaminant in NPDES permit actions using the State's existing narrative criteria for toxics.

[K] This recommended criterion is based on a 304(a) aquatic life criterion that was issued in the 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, (EPA–820–B–96–011, September 1996). This value was derived using the GLI Guidelines (60 FR 15393–15399, March 23, 1995; 40 CFR 132 Appendix A); the difference between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. None of the decisions concerning the derivation of this criterion were affected by any considerations that are specific to the Great Lakes.

[L] The CMC=1/[(f1/CMC1)=(f2/CMC2)] where f1 and f2 are the fractions of total selenium that are treated as selenite and selenate, respectively, and CMC1 and CMC2 are 185.9 µg/l and 12.83 µg/l, respectively.

[M] EPA is currently reassessing the criteria for arsenic. Upon completion of the reassessment the Agency will publish revised criteria as appropriate.

[N] PCBs are a class of chemicals which include aroclors, 1242, 1254, 1221, 1232, 1248, 1260, and 1016, CAS numbers 53469219, 11097691, 11104282, 11141165, 12672296, 11096825 and 12674112 respectively. The aquatic life criteria apply to this set of PCBs.

[O] The derivation of the CCC for this pollutant did not consider exposure through the diet, which is probably important for aquatic life occupying upper trophic levels.

[P] This criterion applies to total pcbs, i.e., the sum of all congener or all isomer analyses.

[Q] This recommended water quality criterion is expressed as µg free cyanide (as CN)/L.

[R] This value was announced (61 FR 58444–58449, November 14, 1996) as a proposed GLI 303(c) aquatic life criterion. EPA is currently working on this criterion and so this value might change substantially in the near future.

[S] This recommended water quality criterion refers to the inorganic form only.

[T] This recommended water quality criterion is expressed in terms of total recoverable metal in the water column. It is scientifically acceptable to use the conversion factor of 0.922 that was used in the GLI to convert this to a value that is expressed in terms of dissolved metal.

[U] The organoleptic effect criterion is more stringent than the value for priority toxic pollutants.

[v] This value was derived from data for heptachlor and the criteria document provides insufficient data to estimate the relative toxicities of heptachlor and heptachlor epoxide.

[w] Although EPA has not published a final criteria document for this compound it is EPA's understanding that sufficient data exist to allow calculation of aquatic criteria. It is anticipated that industry intends to publish in the peer reviewed literature draft aquatic life criteria generated in accordance with EPA Guidelines. EPA will review such criteria for possible issuance as national WQC.

[x] There is a full set of aquatic life toxicity data that show that DEHP is not toxic to aquatic organisms at or below its solubility limit.

[y] This value was derived from data for endosulfan and is most appropriately applied to the sum of alpha-endosulfan and beta-endosulfan.

[z] A more stringent MCL has been issued by EPA. Refer to drinking water regulations (40 CFR 141) or Safe Drinking Water Hotline (1–800–426–4791) for values.

[aa] This CCC is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR 15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[bb] This water quality criterion is based on 304(a) aquatic life criterion that was derived using the 1985 Guidelines (Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, PB85–227049, January 1985) and was issued in one of the following criteria documents: Arsenic (EPA 440/5–84–033), Cadmium (EPA 440/5–84–032), Chromium (EPA 440/5–84–029), Copper (EPA 440/5–84–031), Cyanide (EPA 400/5–84–028), Lead (EPA 440/5–84–027), Nickel (EPA 440/5–86–004), Pentachlorophenol (EPA 440/5–86–009), Toxaphene (EPA 440/5–86–006), Zinc (EPA 440/5–87–003).

[cc] When the concentration of dissolved organic carbon is elevated, copper is substantially less toxic and use of Water-Effect Ratios might be appropriate.

[dd] The selenium criteria document (EPA 440/5–87–006), September 1987) provides that if selenium is as toxic to saltwater fishes in the field as it is to freshwater fishes in the field, the status of the fish community should be monitored whenever the concentration of selenium exceeds 5.0 µg/L in salt water because the saltwater CCC does not take into account uptake via the food chain.

[ee] This recommended water quality criterion was derived on page 43 of the mercury criteria document (EPA 440/5–84–026, January 1985). The saltwater CCC of 0.025 µg/L given on page 23 of the criteria document is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60FR15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[ff] This recommended water quality criterion was derived in Ambient Water Quality Criteria Saltwater Copper Addendum (Draft, April 14, 1995) and was promulgated in the Interim Final National Toxics Rule (60FR22228–222237, May 4, 1995).

[gg] EPA is actively working on this criterion and so this recommended water quality criterion may change substantially in the near future.

[hh] This recommended water quality criterion was derived from data for inorganic mercury (II), but is applied here to total mercury. If a substantial portion of the mercury in the water column is methylmercury, this criterion will probably be under protective. In addition, even though inorganic mercury is converted to methylmercury and methylmercury bioaccumulates to a great extent, this criterion does not account for uptake via the food chain because sufficient data were not available when the criteria was derived.

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR NON PRIORITY POLLUTANTS

	Non priority pollutant	CAS No.	Freshwater		Saltwater		Human health for consumption of:		FR cite/source
			CMC (µg/L)	CCC (µg/L)	CMC (µg/L)	CCC (µg/L)	Water + organism (µg/L)	Organism only (µg/L)	
1	Alkalinity			20000 [F]					Gold Book
2	Aluminum pH 6.5–9.0	7429905	750 [G,I]	87 [G,I,L]					53 FR 33178
3	Ammonia	7664417	FRESHWATER CRITERIA ARE pH DEPENDENT—SEE DOCUMENT						EPA822–R–98–008
			SALTWATER CRITERIA ARE pH AND TEMPERATURE DEPENDENT [D]						EPA440/5–88–004
4	Aesthetic Qualities		NARRATIVE STATEMENT—SEE DOCUMENT						Gold Book
5	Bacteria		FOR PRIMARY RECREATION AND SHELLFISH USES—SEE DOCUMENT						Gold Book
6	Barium	7440393					1,000 [A]		Gold Book
7	Boron		NARRATIVE STATEMENT—SEE DOCUMENT						Gold Book
8	Chloride	16887006	860000 [G]	230000 [G]					53 FR 19028
9	Chlorine	7782505	19	11	13	7.5	[C]		Gold Book
10	Chlorophenoxy Herbicide 2,4,5,-TP	93721					10 [A]		Gold Book
11	Chlorophenoxy Herbicide 2,4-D	94757					100 [A,C]		Gold Book
12	Chloropyrifos	2921882	0.083 [G]	0.041 [G]	0.011 [G]	0.0056 [G]			Gold Book
13	Color		NARRATIVE STATEMENT—SEE DOCUMENT [F]						Gold Book
14	Demeton	8065483		0.1 [F,H]		0.1 [F,H]			Gold Book
15	Ether, Bis Chloromethyl	542881					0.00013 [E]	0.00078 [E]	IRIS 01/01/91
16	Gases, Total Dissolved		NARRATIVE STATEMENT—SEE DOCUMENT [F]						Gold Book
17	Guthion	86500		0.01 [F,H]		0.01 [F,H]			Gold Book
18	Hardness		NARRATIVE STATEMENT—SEE DOCUMENT						Gold Book
19	Hexachlorocyclo-hexane-Technical	319868					0.0123	0.0414	Gold Book
20	Iron	7439896		1000 [F]			300 [A]		Gold Book
21	Malathion	121755		0.1 [F,H]					Gold Book
22	Manganese	7439965					50 [A]	100 [A]	Gold Book
23	Methoxychlor	72435		0.03 [F,H]		0.03 [F,H]	100 [A,C]		Gold Book
24	Mirex	2385855		0.001 [F,H]		0.001 [F,H]			Gold Book
25	Nitrates	14797558					10,000 [A]		Gold Book
26	Nitrosamines						0.0008	1.24	

27	Dinitrophenols	25550587					70	14,000	Gold Book
28	Nitrosodibutylamine,N	924163					0.0064 [A]	0.587 [A]	Gold Book
29	Nitrosodiethylamine,N	55185					0.0008 [A]	1.24 [A]	Gold Book
30	Nitrosopyrrolidine,N	930552					0.016	91.9	Gold Book
31	Oil and Grease		NARRATIVE STATEMENT—SEE DOCUMENT [F]						Gold Book
32	Oxygen, Dissolved	7782447	WARMWATER AND COLDWATER MATRIX—SEE DOCUMENT [O]						Gold Book
33	Parathion	56382	0.065 [J]	0.013 [J]					Gold Book
34	Pentachlorobenzene	608935					3.5 [E]	4.1 [E]	IRIS 03/01/88
35	pH			6.5–9 [F]		6.5–8.5 [F,K]	5–9		Gold Book
36	Phosphorus Elemental	7723140				0.1 [F,K]			Gold Book
37	Phosphate Phosphorus		NARRATIVE STATEMENT—SEE DOCUMENT						Gold Book
38	Solids Dissolved and Salinity						250,000 [A]		Gold Book
39	Solids Suspended and Turbidity		NARRATIVE STATEMENT—SEE DOCUMENT [F]						Gold Book
40	Sulfide-Hydrogen Sulfide	7783064		2.0 [F,H]		2.0 [F,H]			Gold Book
41	Tainting Substances		NARRATIVE STATEMENT—SEE DOCUMENT						Gold Book
42	Temperature		SPECIES DEPENDENT CRITERIA—SEE DOCUMENT [M]						Gold Book
43	Tetrachlorobenzene,1,2,4,5-	95943					2.3 [E]	2.9 [E]	IRIS03/01/91
44	Tributyltin TBT		0.46 [N]	0.063 [N]	0.37 [N]	0.010 [N]			62 FR 42554
45	Trichlorophenol,2,4,5-	95954					2,600 [B,E]	9,800 [B,E]	IRIS 03/01/88

Footnotes:

[A] This human health criterion is the same as originally published in the Red Book which predates the 1980 methodology and did not utilize the fish ingestion BCF approach. This same criterion value is now published in the Gold Book

[B] The organoleptic effect criterion is more stringent than the value presented in the non priority pollutants table.

[C] A more stringent Maximum Contaminant Level (MCL) has been issued by EPA under the Safe Drinking Water Act. Refer to drinking water regulations 40 CFR 141 or Safe Drinking Water Hotline (1–800–426–4791) for values.

[D] According to the procedures described in the Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, except possibly where a very sensitive species is important at a site, freshwater aquatic life should be protected if both conditions specified in Appendix C to the Preamble—Calculation of Freshwater Ammonia Criterion are satisfied.

[E] This criterion has been revised to reflect The Environmental Protection Agency's q1* or RfD, as contained in the Integrated Risk Information System (IRIS) as of April 8, 1998. The fish tissue bioconcentration factor (BCF) used to derive the original criterion was retained in each case.

[F] The derivation of this value is presented in the Red Book (EPA 440/9–76–023, July, 1976).

[G] This value is based on a 304(a) aquatic life criterion that was derived using the 1985 Guidelines (Guidelines for Deriving Numerical National Water Quality Criteria for the Protection of Aquatic Organisms and Their Uses, PB85–227049, January 1985) and was issued in one of the following criteria documents: Aluminum (EPA 440/5–86–008); Chloride (EPA 440/5–88–001); Chloropyrifos (EPA 440/5–86–005).

[H] This CCC is based on the Final Residue Value procedure in the 1985 Guidelines. Since the publication of the Great Lakes Aquatic Life Criteria Guidelines in 1995 (60 FR 15393–15399, March 23, 1995), the Agency no longer uses the Final Residue Value procedure for deriving CCCs for new or revised 304(a) aquatic life criteria.

[I] This value is expressed in terms of total recoverable metal in the water column.

[J] This value is based on a 304(a) aquatic life criterion that was issued in the 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water (EPA–820–B–96–001). This value was derived using the GLI Guidelines (60 FR 15393–15399, March 23, 1995; 40 CFR 132 Appendix A); the differences between the 1985 Guidelines and the GLI Guidelines are explained on page iv of the 1995 Updates. No decision concerning this criterion was affected by any considerations that are specific to the Great Lakes.

[K] According to page 181 of the Red Book: For open ocean waters where the depth is substantially greater than the euphotic zone, the pH should not be changed more than 0.2 units from the naturally occurring variation or any case outside the range of 6.5 to 8.5. For shallow, highly productive coastal and estuarine areas where naturally occurring pH variations approach the lethal limits of some species, changes in pH should be avoided but in any case should not exceed the limits established for fresh water, i.e., 6.5–9.0.

[L] There are three major reasons why the use of Water-Effect Ratios might be appropriate. (1) The value of 87 µg/l is based on a toxicity test with the striped bass in water with pH=6.5–6.6 and hardness <10 mg/L. Data in "Aluminum Water-Effect Ratio for the 3M Plant Effluent Discharge, Middleway, West Virginia" (May 1994) indicate that aluminum is substantially less toxic at higher pH and hardness, but the effects of pH and hardness are not well quantified at this time. (2) In tests with the brook trout at low pH and hardness, effects increased with increasing concentrations of total aluminum even though the concentration of dissolved aluminum was constant, indicating that total recoverable is a more appropriate measurement than dissolved, at least when particulate aluminum is primarily aluminum hydroxide particles. In surface waters, however, the total recoverable procedure might measure aluminum associated with clay particles, which might be less toxic than aluminum associated with aluminum hydroxide. (3) EPA is aware of field data indicating that many high quality waters in the U.S. contain more than 87 µg aluminum/L, when either total recoverable or dissolved is measured.

[M] U.S. EPA. 1973. Water Quality Criteria 1972. EPA–R3–73–033. National Technical Information Service, Springfield, VA.; U.S. EPA. 1977. Temperature Criteria for Freshwater Fish: Protocol and Procedures. EPA–600/3–77–061. National Technical Information Service, Springfield, VA.

[N] This value was announced (62 FR 42554, August 7, 1997) as a proposed 304(a) aquatic life criterion. Although EPA has not responded to public comment, EPA is publishing this as a 304(a) criterion in today's notice as guidance for States and Tribes to consider when adopting water quality criteria.

[O] U.S. EPA. 1986. Ambient Water Quality Criteria for Dissolved Oxygen. EPA 440/5–86–003. National Technical Information Service, Springfield, VA.

NATIONAL RECOMMENDED WATER QUALITY CRITERIA FOR ORGANOLEPTIC EFFECTS

	Pollutant	CAS No.	Organoleptic effect criteria (µg/L)	FR cite/source
1	Acenaphthene	208968	20	Gold Book
2	Monochlorobenzene	108907	20	Gold Book
3	3-Chlorophenol		0.1	Gold Book
4	4-Chlorophenol	106489	0.1	Gold Book
5	2,3-Dichlorophenol		0.04	Gold Book
6	2,5-Dichlorophenol		0.5	Gold Book
7	2,6-Dichlorophenol		0.2	Gold Book
8	3,4-Dichlorophenol		0.3	Gold Book
9	2,4,5-Trichlorophenol	95954	1	Gold Book
10	2,4,6-Trichlorophenol	88062	2	Gold Book
11	2,3,4,6-Tetrachlorophenol		1	Gold Book
12	2-Methyl-4-Chlorophenol		1800	Gold Book
13	3-Methyl-4-Chlorophenol	59507	3000	Gold Book
14	3-Methyl-6-Chlorophenol		20	Gold Book
15	2-Chlorophenol	95578	0.1	Gold Book
16	Copper	744058	1000	Gold Book
17	2,4-Dichlorophenol	120832	0.3	Gold Book
18	2,4-Dimethylphenol	105679	400	Gold Book
19	Hexachlorocyclopentadiene	77474	1	Gold Book
20	Nitrobenzene	98953	30	Gold Book
21	Pentachlorophenol	87865	30	Gold Book
22	Phenol	108952	300	Gold Book
23	Zinc	7440666	5000	45 FR 79341

General Notes:

1. These criteria are based on organoleptic (taste and odor) effects. Because of variations in chemical nomenclature systems, this listing of pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service (CAS) registry numbers, which provide a unique identification for each chemical.

National Recommended Water Quality Criteria

Additional Notes

1. Criteria Maximum Concentration and Criterion Continuous Concentration

The Criteria Maximum Concentration (CMC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed briefly without resulting in an unacceptable effect. The Criterion Continuous Concentration (CCC) is an estimate of the highest concentration of a material in surface water to which an aquatic community can be exposed indefinitely without resulting in an unacceptable effect. The CMC and CCC are just two of the six parts of a aquatic life criterion; the other four parts are the acute averaging period, chronic averaging period, acute frequency of allowed exceedence, and chronic frequency of allowed exceedence. Because 304(a) aquatic life criteria are national guidance, they are intended to be protective of the vast majority of the aquatic communities in the United States.

2. Criteria Recommendations for Priority Pollutants, Non Priority Pollutants and Organoleptic Effects

This compilation lists all priority toxic pollutants and some non priority toxic pollutants, and both human health effect and organoleptic effect criteria issued pursuant to CWA § 304(a). Blank spaces indicate that EPA has no CWA § 304(a) criteria recommendations. For a number of non-priority toxic pollutants not listed, CWA § 304(a) "water + organism" human health criteria are not available, but, EPA has published MCLs under the SDWA that may be used in establishing water quality standards to protect water supply designated uses. Because of variations in chemical nomenclature systems, this listing of toxic pollutants does not duplicate the listing in Appendix A of 40 CFR Part 423. Also listed are the Chemical Abstracts Service CAS registry numbers, which provide a unique identification for each chemical.

3. Human Health Risk

The human health criteria for the priority and non priority pollutants are based on carcinogenicity of 10^{-6} risk. Alternate risk levels may be obtained by moving the decimal point (e.g., for a risk level of 10-5, move the decimal point in the recommended criterion one place to the right).

4. Water Quality Criteria Published Pursuant to Section 304(a) or Section 303(c) of the CWA

Many of the values in the compilation were published in the proposed California Toxics Rule (CTR, 62 FR 42160). Although such values were published pursuant to Section 303(c) of the CWA, they represent the Agency's most recent calculation of water quality criteria and thus are published today as the Agency's 304(a) criteria. Water quality criteria published in the proposed CTR may be revised when EPA takes final action on the CTR.

5. Calculation of Dissolved Metals Criteria

The 304(a) criteria for metals, shown as dissolved metals, are calculated in one of two ways. For freshwater metals criteria that are hardness-dependent, the dissolved metal criteria were calculated using a hardness of 100 mg/l as $CaCO_3$ for illustrative purposes only. Saltwater and freshwater metals' criteria that are not hardness-dependent are calculated by multiplying the total recoverable criteria before rounding by the appropriate conversion factors. The final dissolved metals' criteria in the table are rounded to two significant figures. Information regarding the calculation of hardness dependent conversion factors are included in the footnotes.

6. Correction of Chemical Abstract Services Number

The Chemical Abstract Services number (CAS) for Bis(2-Chloroisopropyl) Ether, has been corrected in the table. The correct CAS number for this chemical is 39638-32-9. Previous publications listed 108-60-1 as the CAS number for this chemical.

7. Maximum Contaminant Levels

The compilation includes footnotes for pollutants with Maximum Contaminant Levels (MCLs) more stringent than the recommended water quality criteria in the compilation. MCLs for these pollutants are not included in the compilation, but can be found in the appropriate drinking water regulations (40 CFR 141.11–16 and 141.60–63), or can be accessed through the Safe Drinking Water Hotline (800–426–4791) or the Internet (http://www.epa.gov/ost/tools/dwstds-s.html).

8. Organoleptic Effects

The compilation contains 304(a) criteria for pollutants with toxicity-based criteria as well as non-toxicity based criteria. The basis for the non-toxicity based criteria are organoleptic effects (e.g., taste and odor) which would make water and edible aquatic life unpalatable but not toxic to humans. The table includes criteria for organoleptic effects for 23 pollutants. Pollutants with organoleptic effect criteria more stringent than the criteria based on toxicity (e.g., included in both the priority and non-priority pollutant tables) are footnoted as such.

9. Category Criteria

In the 1980 criteria documents, certain recommended water quality criteria were published for categories of pollutants rather than for individual pollutants within that category. Subsequently, in a series of separate actions, the Agency derived criteria for specific pollutants within a category. Therefore, in this compilation EPA is replacing criteria representing categories with individual pollutant criteria (e.g., 1,3-dichlorobenzene, 1,4-dichlorobenzene and 1,2-dichlorobenzene).

10. Specific Chemical Calculations

A. Selenium

(1) Human Health

In the 1980 Selenium document, a criterion for the protection of human health from consumption of water and organisms was calculated based on a BCF of 6.0 L/kg and a maximum water-related contribution of 35 µg Se/day. Subsequently, the EPA Office of Health and Environmental Assessment issued an errata notice (February 23, 1982), revising the BCF for selenium to 4.8 L/kg. In 1988, EPA issued an addendum (ECAO–CIN–668) revising the human health criteria for selenium. Later in the final National Toxic Rule (NTR, 57 FR 60848), EPA withdrew previously published selenium human health criteria, pending Agency review of new epidemiological data.

This compilation includes human health criteria for selenium, calculated using a BCF of 4.8 L/kg along with the current IRIS RfD of 0.005 mg/kg/day. EPA included these recommended water quality criteria in the compilation because the data necessary for calculating a criteria in accordance with EPA's 1980 human health methodology are available.

(2) Aquatic Life

This compilation contains aquatic life criteria for selenium that are the same as those published in the proposed CTR. In the CTR, EPA proposed an acute criterion for selenium based on the criterion proposed for selenium in the Water Quality Guidance for the Great Lakes System (61 FR 58444). The GLI and CTR proposals take into account data showing that selenium's two most prevalent oxidation states, selenite and selenate, present differing potentials for aquatic toxicity, as well as new data indicating that various forms of selenium are additive. The new approach produces a different selenium acute criterion concentration, or CMC, depending upon the relative proportions of selenite, selenate, and other forms of selenium that are present.

EPA notes it is currently undertaking a reassessment of selenium, and expects the 304(a) criteria for selenium will be revised based on the final reassessment (63 FR 26186). However, until such time as revised water quality criteria for selenium are published by the Agency, the recommended water quality criteria in this compilation are EPA's current 304(a) criteria.

B. 1,2,4-Trichlorobenzene and Zinc

Human health criteria for 1,2,4-trichlorobenzene and zinc have not been previously published. Sufficient information is now available for calculating water quality criteria for the protection of human health from the consumption of aquatic organisms and the consumption of aquatic organisms and water for both these compounds. Therefore, EPA is publishing criteria for these pollutants in this compilation.

C. Chromium (III)

The recommended aquatic life water quality criteria for chromium (III) included in the compilation are based on the values presented in the document titled: 1995 Updates: Water Quality Criteria Documents for the Protection of Aquatic Life in Ambient Water, however, this document contains criteria based on the total recoverable fraction. The chromium (III) criteria in this compilation were calculated by applying the conversion factors used in the Final Water Quality Guidance for the Great Lakes System (60 FR 15366) to the 1995 Update document values.

D. Ether, Bis (Chloromethyl), Pentachlorobenzene, Tetrachlorobenzene 1,2,4,5- Trichlorophenol

Human health criteria for these pollutants were last published in EPA's Quality Criteria for Water 1986 or "Gold Book". Some of these criteria were calculated using Acceptable Daily Intake (ADIs) rather than RfDs. Updated q1*s and RfDs are now available in IRIS for ether, bis (chloromethyl), pentachlorobenzene, tetrachlorobenzene 1,2,4,5-, and trichlorophenol, and were used to revise the water quality criteria for these compounds. The recommended water quality criteria for ether, bis (chloromethyl) were revised using an updated q1*, while criteria for pentachlorobenzene, and tetrachlorobenzene 1,2,4,5-, and trichlorophenol were derived using an updated RfD value.

E. PCBs

In this compilation EPA is publishing aquatic life and human health criteria based on total PCBs rather than individual arochlors. These criteria replace the previous criteria for the seven individual arochlors. Thus, there are criteria for a total of 102 of the 126 priority pollutants.

Dated: October 26, 1998.

J. Charles Fox,

Assistant Administrator, Office of Water.

Appendix A—Conversion Factors for Dissolved Metals

Metal	Conversion factor freshwater CMC	Conversion factor freshwater CCC	Conversion factor saltwater CMC	Conversion factor saltwater CCC
Arsenic	1.000	1.000	1.000	1.000
Cadmium	1.138672-[(ln hardness) (0.041838)]	1.101672-[(ln hardness) (0.041838)]	0.994	0.994
Chromium III	0.316	0.860		
Chromium VI	0.982	0.962	0.993	0.993
Copper	0.960	0.960	0.83	0.83
Lead	1.46203-[(ln hardness) (0.145712)]	1.46203-[(ln hardness) (0.145712)]	0.951	0.951
Mercury	0.85	0.85	0.85	0.85
Nickel	0.998	0.997	0.990	0.990
Selenium			0.998	0.998
Silver	0.85		0.85	
Zinc	0.978	0.986	0.946	0.946

Appendix B—Parameters for Calculating Freshwater Dissolved Metals Criteria That Are Hardness-Dependent

Chemical	m_A	b_A	m_C	b_C	Freshwater conversion factors (CF)	
					Acute	Chronic
Cadmium	1.128	−3.6867	0.7852	−2.715	1.136672-[ln (hardness)(0.041838)]	1.101672-[ln (hardness)(0.041838)]
Chromium III	0.8190	3.7256	0.8190	0.6848	0.316	0.860
Copper	0.9422	−1.700	0.8545	−1.702	0.960	0.960
Lead	1.273	−1.460	1.273	−4.705	1.46203-[ln (hardness)(0.145712)]	1.46203-[ln (hardness)(0.145712)]
Nickel	0.8460	2.255	0.8460	0.0584	0.998	0.997
Silver	1.72	−6.52			0.85	
Zinc	0.8473	0.884	0.8473	0.884	0.978	0.986

Appendix C—Calculation of Freshwater Ammonia Criterion

1. The one-hour average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the average, the CMC calculated using the following equation:

$$CMC = \frac{0.275}{1+10^{7.204\text{-pH}}} + \frac{39.0}{1+10^{\text{pH-}7.204}}$$

In situations where salmonids do not occur, the CMC may be calculated using the following equation:

$$CMC = \frac{0.411}{1+10^{7.204\text{-pH}}} + \frac{58.4}{1+10^{\text{pH-}7.204}}$$

2. The thirty-day average concentration of total ammonia nitrogen (in mg N/L) does not exceed, more than once every three years on the average, the CCC calculated using the following equation:

$$CCC = \frac{0.0858}{1+10^{7.688\text{-pH}}} + \frac{3.70}{1+10^{\text{pH-}7.688}}$$

Editorial Note: FR Doc. 98-30272 was originally published as Part IV (63 FR 67548-67558) in the issue of Monday, December 7, 1998. At the request of the agency, due to incorrect footnote identifiers in the tables, the corrected document is being republished in its entirety.

[FR Doc. 98–30272 Filed 12–4–98; 8:45 am]

BILLING CODE 1505–01–D

EE/CA and RI/FS Support Sampling Plan

Sauget Area 1

Sauget and Cahokia, Illinois

Volume 1C

Ecological Risk Assessment Work Plan

June 25, 1999

Submitted To:

U.S. Environmental Protection Agency
Chicago, Illinois

Submitted By:

Solutia Inc.
St. Louis, Missouri

ECOLOGICAL RISK ASSESSMENT WORK PLAN
FOR
SAUGET AREA I

SAUGET, ST. CLAIR COUNTY, ILLINOIS

August 11, 1999

Prepared for:

Solutia, Inc.
10300 Olive Boulevard
St. Louis, Missouri 63166-6760

Prepared by:

Menzie-Cura & Associates, Inc.
One Courthouse Lane, Suite Two
Chelmsford, Massachusetts 01824
Phone: (978) 453-4300

TABLE OF CONTENTS:

1.0 INTRODUCTION

1.1 Goals and Objectives

This document is a workplan for a baseline ecological risk assessment at the Sauget Area I in Sauget, Illinois. The plan addresses Dead Creek Segments B, M, C, D, E, and F, and recent USEPA comments regarding the development of a baseline ecological risk assessment for this area (USEPA, 1999). It is also contingent upon a planned field reconnaissance of the subject areas. In particular, this planned reconnaissance will help to finalize sampling locations, receptors, and the location of a reference area. Observations made during the reconnaissance may necessitate alterations in the workplan. We will communicate such proposed alterations in a technical amendment to the plan, should they occur.

The plan follows current United States Environmental Protection Agency (USEPA) guidance in:

> *Ecological Risk Assessment Guidance For Superfund: Process For Designing and Conducting Ecological Risk Assessments* (USEPA, 1997a); and
>
> *Guidelines for Ecological Risk Assessment* (EPA/630/R-95/002F, April, 1998).

The USEPA 1997 guidance document provides an eight-step process. Steps 1 and 2 of this process are a screening level assessment, and Steps 3 through 7 provide guidance for a baseline assessment. The screening level assessment may conclude that site data indicate either:

> a negligible ecological risk and therefore the site requires no further study; or, there is (or might be) a risk of adverse ecological effects, and the ecological risk assessment process will continue.

Previously, the USEPA conducted a Preliminary Ecological Assessment of Dead Creek Segment F, which essentially provides the screening analyses required in Steps 1 and 2 of the guidance (USEPA, 1997b). This USEPA assessment concluded that the site warrants further investigation. Therefore this Work Plan addresses the various elements of Steps 3 through 7 of USEPA guidance for designing a baseline ecological risk assessment to Segment F, as well as Segments B, C, D, E even though they have not been subject to a prior screening level assessment. The workplan includes:

- Description of a Site Conceptual Model;
- Selection of Chemicals of Ecological Concern;
- Identification of Assessment Endpoints;
- Selection of Receptors;
- Selection of Measures of effects and their relation to assessment endpoints;
- Risk Characterization;
- Discussion of Uncertainties and Assumptions.

The workplan will explain how the baseline risk assessment will use data described in the Quality Assurance Project Plan/Field-Sampling Plan (QAPP/FSP), that has been prepared and submitted separately. The FSP for the baseline ecological risk assessment describes the details of the field sampling effort as well as the data analysis methods and data quality objectives (DQOs). These include methods for:

- conducting a field reconnaissance;
- collecting vegetation and benthic organisms in Creek Sectors B to F, M, and the reference areas, and analyzing them for target analytes;
- collecting forage fish, predator fish, bottom fish and crayfish in Creek Sector F and the reference areas, and analyzing them for target analytes (we will also collect these organisms in segments B,C,D,E, and, M if observed in those areas);
- collecting sediments in Creek Sectors B to F, M, and the reference areas for sediment toxicity testing;
- collecting sediments in Creek Sectors B to F, M, and the reference areas for benthic community analysis.

Please refer to the QAPP/FSP for details of field sampling, number of stations, and station locations, and analytical methods.

2.0 SITE CONCEPTUAL MODEL

2.1 Ecological Observations

We will conduct a reconnaissance survey to provide more details and more current information regarding ecological conditions at the various creek sectors. This section provides a description of the site as observed on 29-30 July 1996, when Menzie-Cura & Associates, Inc. personnel (David Peterson, Certified Wildlife Biologist), visited the Sauget Area 1 in Sauget and Cahokia, Illinois and conducted an evaluation of local habitats. The areas observed at that time included ecological resources along: Dead Creek, Prairie du Pont Creek, the associated wetlands, Cahokia Chute, and the Mississippi River. In addition, we contacted federal/state agencies and private conservation organizations concerning additional ecological information available about the area (see Attached List).

Potentially sensitive environments in the Dead Creek area include: Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened (T/E) Species, Habitat Known to be Used by State Designated Endangered or Threatened Species, and Wetlands.

Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species

According to the records of the Illinois Department of Natural Resources' Natural Heritage Inventory, the only federally endangered or threatened species in the study area is the federally threatened bald eagle (*Haliaeetus leucocephalus*). In 1993, a pair of eagles unsuccessfully attempted to nest at the southern tip of Arsenal Island, where the ditched portion of Prairie du Pont Creek enters the Mississippi River. The pair apparently was scared off the site. The next year the pair returned to the island, but no monitoring was conducted to determine if they successfully nested. During the late July 1996 survey we did not observe any eagles in the study area. Remains of a large stick nest were observed at the southern tip of Arsenal Island, but it did not appear to have been used during 1996. We will also check the State of Missouri files for State Designated Endangered or Threatened Species.

Portions of the area suitable for eagle foraging include waterbodies large enough to support large fish such as carp and catfish. The Mississippi River, the channelized section of Prairie du Pont Creek, and a borrow pond at the lower end of Dead Creek all appear to support large fish and provide enough open water for eagles to fish. No foraging eagles were observed during the site visit, nor have local people in the area seen eagles in the vicinity.

Habitat Known to be Used by State Designated Endangered or Threatened Species

The Illinois Natural Heritage Inventory did not have any records of state-listed endangered or threatened species in the study area. However a number of state-listed wading birds were observed throughout the wetlands and waterways. Illinois endangered species observed were little blue heron (*Egretta caerulea*), snowy egret (*Egretta thula*)[1], and black-crowned night heron (*Nycticorax nycticorax*). Great egret (*Casmerodius albus*), an Illinois threatened species, was also observed. Small numbers (one to ten individuals) of these wading birds were found foraging along sections of Dead Creek, the ditched length of Prairie du Pont Creek, Cahokia Chute, and the Mississippi River. The largest concentrations of foraging herons (approximately ten individuals at a location) were observed at the confluence of Dead Creek and the ditched Prairie du Pont Creek, and where the ditched Prairie du Pont flows into the Mississippi. These areas likely support the best concentrated fishing areas for wildlife along the waterways.

No wading bird colonies were located within the study area. However, the Illinois Natural Heritage Inventory has documented two 1000-2000 nest mixed-species colonies in East St. Louis. The closest of these two colonies is approximately one mile east of the Monsanto plant near the Alton & Southern rail yards in Alorton. The second site is over two miles to the north at Audubon Avenue and 26th Street. These two colonies contain the only breeding little blue heron and snowy egret in Illinois. In addition, black-crowned night heron, great egret, cattle egret (*Bubulcus ibis*), great blue heron (*Ardea herodias*), and green-backed heron (*Butorides virescens*) nest in the colonies.

In 1988, because the region is heavily industrialized with numerous Superfund sites, the U.S. Fish & Wildlife Service (USFWS) collected black-crowned night heron and little blue heron eggs from the Alorton colony for contaminant analysis (Young, 1989 - unpublished draft). Sediment samples were also taken in areas of observed wading bird foraging around the East St. Louis region. No testing was done of sediments in the Dead Creek drainage. PCB's, DDE, and metals were detected at varying levels from the wading bird eggs.

The observed endangered and threatened wading birds forage on a wide range of aquatic organisms, such as fish, frogs, and crayfish, as well as some terrestrial species such as reptiles and insects. The USFWS study found that wading birds forage over a wide area around East St. Louis. The Dead Creek/Prairie du Pont wetlands system composes a relatively small percentage of the available wetland foraging area in the region.

Wetlands

Wetlands in the study area consist of riparian woods, shrub swamp, marsh, and wet meadow located adjacent to the area's waterways. Drainage from much of the industrial area at the head of Dead Creek is routed away from the Dead Creek drainage via the local municipal sewer system. Dead Creek begins south of an industrial zone adjacent to the Cerro property and flows slowly south through residential neighborhoods. The stream is bordered by a dense, narrow band of riparian trees and shrubs, including cottonwood, willow, mulberry, and box elder (Photo B-1). Homeowners have cleared to the creek's edge and have established lawn along several sections. Within the residential area (east of Route 3) the stream is crossed, via

[1] Also endangered in Missouri.

culverts, by seven roads. At the Judith Lane road crossing, the road culvert has been set approximately one foot higher than the observed water level, apparently to allow drainage of the channel only during high-water events. The pooled channel behind this road is connected to a small pond located at the end of Walnut Street where herons, painted turtle, wood duck, fish, and evidence of beaver (chewed trees, see Photo B-2) were observed (see Table B-1).

Downstream of the impounded channel, Dead Creek segments C and D flow south through bordering wetlands (Photo B-3, note Green Backed Heron in center of photograph). For a short section, adjacent to Parks College, the creek is routed through a culvert under a parking area. Throughout the rest of the creek's length it is bordered by either riparian vegetation (Photo B-4) or lawn (Photo B-5). Emergent and aquatic vegetation occurs along the creek's shores. Wildlife observed in and adjacent to the stream included herons, turtles, songbirds, squirrel, and raccoon. Small fish and frogs were observed throughout the creek's length.

West of Route 3, the creek flows south and west through the American Bottoms floodplain. This area contains active and abandoned agricultural land divided by levees and railroad right-of-ways. After crossing Route 3 Dead Creek flows under a railroad right-of-way and is joined by a stream draining land from the north. North of the confluence of these two waterways is a road that cuts SE to NW across the floodplain, connecting Cahokia to Fox Terminal. To the north (upstream) of this road is a gas tank farm and fields. The stream was observed to flow south under the Fox Terminal road and into Dead Creek. A second dry culvert was observed west of the stream crossing in the vicinity of the north end of the Dead Creek borrow pond. This culvert appeared to drain the land north of the Fox Terminal road during high-water events when water from the tank farm and surrounding area becomes impounded behind the roadway.

Downstream of the confluence of the two waterways, Dead Creek flows through riparian woods and shrubs and into a borrow pond. The pond appears to have been excavated during the construction of the local levee system. The United States Geological Survey (USGS) map of the area (Cahokia) indicates that the pond was dug to its current shape sometime after 1954. The pond is the largest non-flowing water body in the area. Its shore is surrounded with mature riparian trees and emergent wetland vegetation. Ducks, herons, and fish were observed in the pond.

Dead Creek forms the outlet of the pond, draining south through a pump station under the levee (Photo B-6) and into the ditched section of Prairie du Pont Creek. At the confluence and above it (Photo B-7) the ditch shore is vegetated with grasses, herbs, and small shrubs. The channel flows northwest to Arsenal Island on the Mississippi River. Arsenal Island contains areas of mature riparian woods and agricultural fields. The shoreline of the lower end of the ditch (referred to on the USGS map as Cahokia Chute) is lined with riparian woods, principally large cottonwoods and willow (Photo B-8). Large catfish, wood duck, wading birds, and turtles were observed in the channel. Cahokia Chute forms the eastern border of Arsenal Island. The waterway flows north to south, draining the region northeast of the island. It appears that during times when the Mississippi River is high, the River uses the Chute channel to flow around Arsenal Island. Any water from the Dead Creek watershed therefore only flows through the lower half of the Cahokia Chute between the confluence with the ditched Prairie du Pont and the Mississippi River. The remains of the bald eagle nest and congregating wading birds were observed at the southern tip of Arsenal Island, where the Chute flows into the Mississippi.

Almost the entire length of the Dead Creek study area is bordered by wetlands. Most of the wetlands are confined to a narrow riparian strip adjacent to the Creek. More extensive wetlands occur west of Route 3, particularly in the vicinity of the borrow pond. The Creek's wetlands appeared healthy with no evidence of ecological stress (no chlorotic plants, no nonspecific stands of vegetation, no areas of dying or dead vegetation, observable presence of diverse pelagic communities in the stream, no observed surface water sheens or sediment staining). The wetlands also appeared to support a diverse aquatic and terrestrial wildlife community, with abundant prey species (i.e. fish, frogs, turtles) and predatory species (i.e. wading birds, waterfowl, raccoons) present. The wetlands west of Route 3 receive water from both Dead Creek and from drainages to the north, including the area around the gas tank farm.

Summary

During the field survey and subsequent contact with state and federal agencies, three categories of sensitive environments were located in the Monsanto/Dead Creek area: Habitat Known to be Used by Federal Designated or Proposed Endangered or Threatened Species, Habitat Known to be Used by State Designated Endangered or Threatened Species, and Wetlands. These three categories are interrelated with the rare species documented all utilizing wetland/waterway habitats. The rare species observed forage over a wide area, with the Dead Creek watershed forming only a small part of their available feeding territory.

The Dead Creek watershed also appears to support a diverse plant and animal community. While much of the Creek flows through residential neighborhoods, sufficient natural riparian vegetation remains to support local aquatic and terrestrial communities. No evidence of ecological stress was evident in the upper Creek, nor anywhere else along the waterway's path to the Mississippi.

2.2 Site Conceptual Model

The foundation of an ERA work plan is the site conceptual model. It integrates information from the preliminary observations at the site (usually incorporated into the screening level risk assessment). According to EPA guidance, the conceptual model addresses:

environmental setting and contaminants known or suspected to exist at the site;

contaminant fate and transport mechanisms;

mechanisms of ecotoxicity and likely categories of potentially affected receptors;

complete exposure pathways.

Figure 1C-1 provides a Preliminary Conceptual Model diagram. It illustrates potential contaminant transport from the contaminated media through the potentially affected habitats to important ecological receptors. We will revisit and, if necessary, amend this model after completion of the site reconnaissance survey.

The site conceptual model is consistent with our knowledge of the area to date as described in our 1996 survey and in the recent EPA Preliminary Risk Assessment.

Environmental Setting and Contaminants Known Or Suspected To Exist At The Site

Subsection 2.1 describes the environmental setting. The EPA Preliminary Ecological Risk Assessment describes the contaminants known or suspected to be at the site. The environmental setting is an aquatic environment with extensive wetlands, riparian woods, narrow, shallow streams, broader semi-impounded basins, and floodplain.

The likely contaminants include those addressed in the EPA assessment:

metals (arsenic, barium, cadmium, chromium, lead, mercury);

PCBs;

PAHs;

dioxin.

The eventual execution of the QAPP/FSP will analyze for a broader list of potential contaminants in sediments, surface water, and biota. We will evaluate those data within the baseline risk assessment and add contaminants as appropriate based on: frequency of occurrence within a particular media, likely bioavailabilty, evidence for bioaccumulation, toxicity to likely receptors, and comparison of concentrations to a reference area. Obviously, the addition of more contaminants of concern may require changes in the conceptual model for the baseline risk assessment depending upon the fate, transport, and biological properties of these contaminants. The EPA guidance recognizes and encourages this iterative process.

Contaminant Fate and Transport Mechanisms

In an aquatic system such as occurs over Dead Creek Sectors B through F, and M, various physical, chemical, and biological transport mechanisms will affect the fate of contaminants. All the contaminants listed in the EPA Preliminary Assessment adhere to particulate matter to varying degrees. Therefore, the conceptual model should address those mechanism affecting particle distribution in aquatic systems. These include:

particulate runoff from the watershed,

deposition in areas of sluggishly flowing waters,

erosion in faster moving stream segments, and

resuspension of particulates from the stream bed and over the floodplain.

Chemicals with lower particle affinities may be more subject to dissolution in and transport by surface water. Increasing solubility generally correlates with increasing bioavailability. In particular, various metals on the preliminary list of contaminants are subject to transport in soluble form, depending on their valence states.

The major biological mechanisms affecting fate and transport are:

biological uptake directly from environmental media; and,

bioaccumulation through ingestion of prey or media;

biomagnification through the food chain.

Several of the contaminants are subject to one or all of these biological fate and transport mechanisms.

The baseline risk assessment will describe each contaminant of concern (including any added after the next sampling rounds) in terms of the transport mechanisms most likely to affect it. The EPA Preliminary Risk Assessment provides a description of the likely transport mechanisms for each of the contaminants or classes of contaminants listed.

Mechanisms of Ecotoxicity And Likely Categories Of Potentially Affected Receptors

The EPA Preliminary Risk Assessment summarizes the ecotoxicological properties of the potential contaminants in sufficient detail to develop the first iteration of the conceptual model. As indicated in the summaries, the various contaminants may affect the survival and reproductive capacity of benthic biota, fish, invertebrates, vascular plants, and algae.

The baseline risk assessment will provide detailed ecotoxicity profiles for the final list of contaminants of concern. These will include summaries of the toxicity of these chemicals to receptors likely to occur in the Dead Creek environment (insofar as these exist), and a selection of the most appropriate toxicity factor to use in the baseline risk assessment.

The categories of likely potentially affected receptors for an aquatic system such as the Dead Creek, Sectors B through F, and M include:

The benthic macroinvertebrate community;

warm water fish (e.g., largemouth bass);

waterfowl (e.g. mallard) that feed on plants and macroinvertebrates (including crayfish);

piscivorous birds (e.g., great blue heron, bald eagle);

aquatic mammals (e.g. muskrat) that feed on plants and macroinvertebrates (including crayfish);

aquatic mammals (e.g., river otter or racoon) that feed on fish and macroinvertebrates (including crayfish).

There is also some potential for exposure to terrestrial plants and wildlife from exposure to contaminants in soil or through exposure to soil based food chains.

Complete Exposure Pathways

The USEPA guidance indicates that the risk assessment must identify complete exposure pathways before a quantitative evaluation of toxicity to allow the assessment to focus on those contaminants that can reach ecological receptors. The likely complete exposure pathways in Dead Creek, Sectors B through F, and M are:

- sediment to benthic invertebrates via direct contact and ingestion;
- sediment and surface water to aquatic plants via uptake;
- surface water to invertebrates and fish though direct contact and ingestion;
- benthic biota (including crayfish) to higher order predators (e.g. fish) through food chain;
- forage fish and crayfish to piscivorous fish, mammals, or birds;
- soil to soil invertebrates along the creek banks or floodplain;
- soil to plants or wildlife along the creek banks or floodplain.

3.0 SELECTION OF CHEMICALS OF ECOLOGICAL CONCERN (COECs)

As indicated in subsection 2.2, the USEPA Preliminary Risk Assessment provides an initial list of contaminants of ecological concern (COECs). The QAPP/FSP includes target analytes beyond these initial COECs. These target analytes include: VOCs, metals, SVOCs, PCBs, and pesticides.

The baseline risk assessment will re-evaluate the COEC list based in the results of the proposed sampling and analysis of surface water, sediment, and biota. The criteria for final selection include:

> Comparison to Background – the baseline risk assessment will eliminate a contaminants which occurs below the maximum concentration measured at a local reference area for a given medium;
>
> Frequency of Detection – the baseline risk assessment will retain a contaminant detected in more than 5% of samples for a particular media.

For those compounds which exceed background and/or are frequently detected in a particular medium, the baseline risk assessment will add them to the final list of COECs if they exhibit any of the following characteristics:

> Toxic – exhibit toxicity (based on scientific literature) to the receptors likely to occur along the Dead Creek, Sectors B through F and M, or adjacent habitats;
>
> Bioaccumulative – are likely to bioconcentrate or biomagnify through the food chains represented in Dead Creek, Sectors B through F, and M, and adjacent habitats;
>
> Persistent – are likely to remain in environmental media over time frames that are long relative to the life spans or exposure periods of receptors likely to occur in Dead Creek, Sectors B through F, and M, and adjacent habitats.

The ERA will include a current review of toxicological information for all COECs on the final list. Where available, this information will include toxicity benchmarks that are applicable to water and sediments.

4.0 IDENTIFICATION OF RECEPTORS, ASSESSMENT ENDPOINTS, AND MEASURES OF EFFECT

4.1 Receptors

This subsection of the ecological risk assessment identifies the receptors (receptor species) and provides the rationale for their selection as representative of the species that occur or are likely to occur near the site. This subsection also provides an ecological characterization of each receptor for eventual use in developing the exposure assessment.

The selected receptors represent those types of organisms most likely to encounter the contaminants of concern at the site. They include a reasonable (although not comprehensive) cross-section of the major functional and structural components of the ecosystem under study based on:

relative abundance and ecological importance within the selected habitats;

availability and quality of applicable toxicological literature;

relative sensitivity to the contaminants of concern;

trophic status;

relative mobility and local feeding ranges;

ability to bioaccumulate contaminants of concern.

The selected species represent different feeding guilds. This representative species approach for assessing exposures for wildlife is a common practice for assessing risk. A guild is a group of animals within a habitat that use resources in the same way. Coexisting members of guilds are similar in terms of their habitat requirements, dietary habits, and functional relationships with other species in the habitat. Guilds may be organized into potential receptor groups. The use of the guild approach allows focused integration of many variables related to potential exposure. These variables include characteristics of COECs (toxicity, bioaccumulation, and mode of action), and characteristics of potential receptors (habitat, range and feeding requirements, and relationships between species). This approach evaluates potential exposures to all animals by considering the major feeding guilds found in a habitat. It is assumed that evaluation of the potential effects of COECs to the representative species will be indicative of the potential effects of COECs to individual member classes of organisms within each feeding guild.

The selected species represent the ecological community and its sensitivity to the contaminants of concern. They are: benthic invertebrates, shellfish, local fin fish, great blue heron, mallard, bald eagle, muskrat, and river otter or raccoon.

Benthic invertebrates

Benthic invertebrates are potential receptor species in Dead Creek because they:

have the greatest exposure to sediments;

provide food for bottom-feeding fish species (in the river);

are relatively immobile (sessile) in habit, and therefore their general health and condition reflects local conditions;

Warm Water Fish Species

Warm water resident fish species were selected to reflect local sediment and water quality conditions. The typical warm water fish species such as centrachids (sunfish, bass) and bottom feeding fish such as bullheads are likely and abundant local resident with a limited foraging range. These organisms are potential receptor species representing local fish because they are:

resident in this reach of the Dead Creek;

exposed to sediments as well as surface water;

represent forage fish and higher order predators feeding on smaller fish and invertebrates.

Aquatic Birds

We have selected great blue heron, mallard duck, and bald eagle to represent aquatic birds feeding in Dead Creek, Sectors B through F, and M for at least a portion of the time.

Great Blue Heron (*Ardea herodias*)

The great blue heron inhabits salt and freshwater environments, typically shallow waters and shores of lakes, flooded gravel pits, marshes and oceans. In marsh environments, the great blue heron is an opportunistic feeder; they prefer fish, but they will also eat amphibians, reptiles, crustaceans, insects, birds, and mammals. The diet varies but may include up to 100% fish. A Nova Scotia study found 6% forage fish (Atlantic silverside and mummichog), 52.6% eels, and 41.4% other fish in the diet of great blue heron (USEPA, 1993). A food ingestion rate for adult breeding birds of 0.18 g food/g body weight/day has been reported.

Great blue heron tend to forage near nesting sites (USEPA, 1993). A study in Minnesota measured the distance between nesting and foraging grounds to range from 0 to 2.7 miles. A Carolina study found the same distance to be 4 to 5 miles. The maximum distance great blue heron will fly between foraging areas is 9 to 13 miles (USEPA, 1993). The size of the feeding territory in a freshwater area in Oregon was 1.5 acres, while the feeding territory in an estuarine area was 21 acres.

These organisms are potential receptor species because they:

Consume near shore fish;

Have a foraging range about equal to the downstream area of the Dead Creek sectors;

Are a higher trophic level predator in the creek and Mississippi.

Great blue heron, therefore, represent piscivorous birds in this reach of the river.

Mallard (*Anas platyrhynchos*)

The mallard is the most common freshwater duck of the United States, found on lakes, rivers, ponds, etc. It is a dabbling duck, and feeds (usually in shallow water) by "tipping up" and eating food off the bottom of the water body. Primarily, it consumes aquatic plants and seeds (for instance, primrose willow and bulrush seeds), but it will also eat aquatic insects, other aquatic invertebrates, snails and other molluscs, tadpoles, fishes, and fish eggs. Ducklings and breeding females consume mostly aquatic invertebrates. The mallard's home range is variable, but an approximate range is 500 hectares. It prefers to nest on ground sheltered by dense grass-like vegetation, near the water.

Mallards are a potential receptor species because they:

Consume both aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level duck in the creek and in Mississippi.

Mallards, therefore, represent waterfowl in this reach of the river.

Bald Eagle (*Haliaeetus leucocephalus*)

Bald eagles are generally found in coastal areas, near lakes or rivers. Their preferred breeding sites are in large trees near open water. They are usually found in areas with minimal human activity.

Bald eagles, although primarily carrion feeders, are opportunistic and will eat whatever is plentiful including fish, birds, and mammals. Reported food ingestion rates range from 0.064 to 0.14 g/g/day. A study of adult breeding bald eagles in Connecticut estimated a food ingestion rate of 0.12 g/g/day (USEPA, 1993). A study of bald eagle diets in Maine indicated that their diets consisted of 76.7% fish, 16.5% birds, and 6.8% mammals (USEPA, 1993).

Foraging areas vary according to season and location. The USEPA (1993) reports a foraging length of 2 to 4.5 miles along a river.

These organisms are potential receptor species because they:

Consume fish;

Are a higher trophic level predator in the river;

Are sensitive to contaminants that biomagnify in the food chain.

The bald eagle, therefore, represents predatory birds in these sectors of Dead Creek.

Aquatic Mammals

This assessment assumes that either river otter (or racoon if the site reconnaissance indicates that otter are unlikely to occur in the area) and muskrat represent aquatic mammals in Dead Creek sectors B through F.

River Otter (*Lutra canadensis*)

The river otter can be found in primarily freshwater but also saltwater environments, but seems to prefer flowing-water habitats rather than still water. It has been found in lakes, marshes, streams, and seashores. It consumes largely fish, but is opportunistic and will consume aquatic invertebrates (crabs, crayfish, etc.), aquatic insects, amphibians, birds (e.g. ducks), small or young mammals, and turtles. They may also sift through sediment for food. The otter dens in banks, in hollow logs, or similar burrow-like places. Home range varies depending on habitat and sex, but an approximate measure is 300 hectares.

River otters are a potential receptor species because they:

Consume fish and aquatic invertebrates;

Live in or near the water;

Are a higher trophic level predator in the creek and in Mississippi.

River otters, therefore, represent higher trophic level aquatic mammals in this reach of the river.

Raccoon (*Procyon lotor*)

The raccoon is likely to be present because the creek and surrounding areas consist of its most preferred types of habitat (marshes and suburban residential areas). Because the raccoon is an omnivore, it is likely to experience greater exposure to than the muskrat which is primarily a herbivore. The raccoon is known to consume aquatic invertebrates (such as crayfish), fish, insects, mollusks, annelids, bird eggs, small passerine birds, small mammals such as squirrels, and plants (Chapman and Feldhamer, 1990).

Raccoon are a potential receptor species because they:

Consume fish and aquatic invertebrates;

Live near the water;

Are a higher trophic level predator in the creek and in Mississippi.

Raccoon, therefore, represent higher trophic level aquatic mammals in this reach of the river.

Muskrat (*Ondatra zibethicus*)

The muskrat is a semiaquatic large rodent which lives near freshwater and brackish aquatic environments: marshes, ponds, creeks, lakes, etc. It feeds largely on aquatic plants, but depending on location and time of year may also consume aquatic invertebrates (crayfish, crabs, etc.), small amphibians, turtles, fish, molluscs, and even young birds. The muskrat lives quite close to the water, either on the bank of the water body or constructing a lodge in the water body. Its home range is small (0.17 hectares on average) and one study found that muskrats remain within 15 meters of their primary dwellings 50 percent of the time.

Muskrats are a potential receptor species because they:

Consume aquatic plants and aquatic invertebrates;

Live on or near the water;

Are a lower trophic level omnivore in the creek and in Mississippi.

Muskrats, therefore, represent lower trophic level aquatic mammals in this reach of the river.

Soil invertebrates

Soil invertebrates are potential receptor species in Dead Creek banks and floodplain because they:

have the greatest exposure to soil;

provide food for birds and mammals (in the river);

are relatively immobile (sessile) in habit, and therefore their general health and condition reflects local conditions;

4.2 Assessment Endpoints

Assessment endpoints are expressions of the environmental value to be protected at a site. Assessment endpoints are often not directly measurable. Therefore, assessment employs measures of effects. These are biological or measurable ecological characteristics which reflect the assessment endpoint (USEPA, 1997). Where the assessment endpoint is not directly measurable, the use of a measure of effect may result in some uncertainty in the risk characterization. Ultimately, the selection of assessment endpoints requires the consensus of the regulators, the regulated community, and state or local concerns. This work plan proposes the following assessment endpoints for the potentially-affected aquatic receptors and their habitats:

Sustainability (survival, growth, and reproduction) of warm water fish species typical of those found in similar habitats (incorporates the assessment of benthic macroinvertebrates and crayfish);

Survival, growth, and reproduction of local populations of aquatic wildlife represented by bald eagles, mallard duck, great blue heron, muskrat, and river otter or raccoon (incorporates the assessment of benthic macroinvertebrates and crayfish).

The assessment will evaluate risk relative to these assessment endpoints in Creek, Sectors B through F and M, collectively and individually, based on prior observations and the work proposed in the QAPP/FSP.

4.3 Selection of Measures of Effects

The measures of effect direct data collection needs for the baseline ecological risk assessment. They provide the actual measurements for estimating risk. A weight-of-evidence approach (Menzie et al., 1996) weighs each of the measures of effects by considering:

strength of association between the measure of effects and assessment endpoint;

data quality; and

study design and execution.

Strength of association refers to how well a measure of effects represents an assessment endpoint. The greater the strength of association between the measurement and assessment endpoint, the greater the weight given to that measure of effect in the risk analysis.

The weight given a measure of effect also depends on the quality of the data as well as the overall study design and execution. The QAPP/FSP describes a sampling program that will provide information adequate for evaluating each selected measure. However, the risk assessment must evaluate the performance of the sampling effort and the variability and uncertainties associated with the results following implementation. The risk characterization gives higher weight to measures of effect that are based on good quality data and are obtained using study designs that account for confounding variables.

There is considerable uncertainty associated with estimating risks, because ecological systems are complex and exhibit high natural variability. Measures of effects typically have specific strengths and weaknesses related to the factors discussed above. Therefore, it is common practice to use more than one measure of effect to evaluate each assessment endpoint. This subsection describes the measures of effects and how the baseline risk assessment will use them to evaluate risks for each of the assessment endpoints.

TABLE 1
ASSESSMENT ENDPOINTS
AND ASSOCIATED MEASURES OF EFFECTS

Assessment Endpoint 1: Sustainability of warm water fish in Creek Sector F

Measure of effect 1a: body burdens of COECs in selected fish species as a measure of exposure (compared to body burdens in fish from reference areas) and effects (compared to benchmark values).

Measure of effect 1b: COEC concentrations in surface waters as compared to applicable water quality criteria for protection of fish and wildlife.

Measure of effect 1c: sustainability of a benthic macroinvertebrate community that can serve as a prey base for fish:

Concentration of COECs in sediment;

Field assessment of benthic macroinvertebrate community structure (using EPA Rapid Bioassessment Protocol I, as described in *Rapid Bioassessment Protocols for Use in Streams and Rivers, Benthic Macroinvertebrates and Fish,* EPA/444/4-89-001.

Sediment toxicity tests.

Assessment Endpoint 2: Survival, growth, and reproduction of local populations of aquatic wildlife as represented by the bald eagle, mallard duck, great blue heron, muskrat, and river otter or raccoon in Creek Sectors B through F, and M

Measure of effect 2a: Wildlife species composition and habitat use.

Measure of effect 2b: Concentration of semi-volatile compounds (SVOCs), metals, mercury, Polychlorinated Biphenyls (PCBs), pesticides, cyanide, herbicides, and dioxin in aquatic and marsh plants for use in evaluating exposure via the food chains for mallard duck, river otter or raccoon , and muskrat.

Measure of effect 2c: Concentration of COECs in surface waters in comparison to wildlife benchmarks.

Measure of effect 2d: Concentration of COECs in forage fish and crayfish for use in evaluating exposure via the food chain for great blue heron and river otter or raccoon.

Measure of effect 2e: Concentration of SVOCs, metals, mercury, PCBs, pesticides, cyanide, herbicides, and dioxin in macroinvertebrates (including crayfish) for use in evaluating exposure via the food chain for mallard duck, river otter or raccoon and muskrat.

Measure of effect 2f: sustainability of a benthic macroinvertebrate community that can serve as a prey base for fish (includes three lines of evidence as in Assessment Endpoint 1).

Assessment Endpoint 3: Survival, growth, and reproduction of individuals within the local bald eagle population in Creek Sectors B through F, and M

Measure of effect 3a: Concentration of COECs in fish for use in evaluating exposure via the food chain.

Assessment Endpoint 4: Survival, growth, and reproduction of local populations of terrestrial wildlife along the banks and floodplain of Creek Sectors B through F, and M

Measure of effect 4a: Soil screening effect levels for the protection of wildlife, plants, and soil dwelling invertebrates.

4.3.1 Measures of Effects for Assessment Endpoint 1, Sustainability of Warm Water Fish

The COECs may exert direct effects on warm water fish through exposure in the water, sediment, or prey, and indirectly by affecting their prey, the macroinvertebrate community. The proposed measures of effects assess exposure pathways and potential effects. Some rely upon direct observations of conditions; some involve measures of toxicity; and others use literature values.

Measure of effect 1a: body burdens of COECs in selected fish species.

Purpose and Rationale. Fish exposed to bioaccumulative compounds in their diet or in water can accumulate these COECs in their tissues. Contaminants tend to accumulate in organs such as the liver and kidney to a greater degree than in the musculature. However, COEC levels in the muscle tissue and on a whole body basis are useful for evaluating risks to animals that eat fish. The assessment will use measurements of COECs in fish tissues to evaluate exposure and effects on the fish, and to provide data for use in other parts of the assessment.

Approach. The assessment will use this endpoint to evaluate exposure and effects. As a measure of exposure, it will compare body burdens of COECs in small forage fish, medium bottom-feeding fish and large piscivorous fish to those same fish species in the reference area. Therefore, the comparisons of fish body will help to assess if fish in Dead Creek are exposed to COECs in excess of those that occur in the reference area. The assessment will also use the body burden data as input to the food chain exposure models for the representative piscivores (the great blue heron, bald eagle, and the river otter or raccoon).

As a measure of effects, the assessment will compare measured body burdens to literature values at which effects have been reported. The Waterways Experiment Station (WES) of the Army Corps of Engineers provides an on-line database and The Society of Environmental Toxicology and Chemistry (Jarvinen and Ankley, 1999) provides a compilation of such residue effect levels. The assessment will query these databases. If body burdens exceed levels at which effects have been reported in the databases, it will be presumed that the measure of effect indicates the potential for effects in the selected fish species found in Dead

Creek.

Measure of effect 1b: COEC concentrations in surface waters as compared to applicable water quality criteria for protection of fish and wildlife.

Purpose and Rationale. Water concentrations provide a measure of exposure, and water quality criteria indicate levels above which effects may occur. This measure of effect will evaluate the potential for water concentrations of COECs in Dead Creek to cause adverse effects.

Approach: The assessment will compare measured concentrations of dissolved metals in surface waters to water quality criteria. Exposure of individual fish and the populations of fish in water will partly depend on the exposure field and the distribution and behavior of the fish. Thus, the area over which water quality criteria are exceeded becomes an important consideration when evaluating exposure. We will evaluate effects with respect to spatial extent and degree to which surface water concentrations exceed water quality criteria.

The USEPA has published an ECO-UPDATE entitled: "Ecotox Thresholds" that includes COEC-specific water quality benchmarks. If an Ecotox Threshold value is available for a COEC, the concentration of the COEC in water will be compared to its respective Ecotox Threshold value. When specific benchmarks are not available and when appropriate, USEPA has suggested using appropriate extrapolations between related species.

Measure of effect 1c: Sustainability of benthic macroinvertebrate communities that comprise a prey base

Purpose and Rationale. Benthic macroinvertebrates are an important source of food for many fish species. They experience direct sediment exposures due to their life histories. Exposures that result in reduced abundance, diversity, or biomass of these aquatic macroinvertebrates, could indirectly effect fish populations. Further, quantitative studies of benthic macroinvertebrates have a long history of use in water quality studies.

The assessment will use the sediment triad approach as part of a weight-of-evidence analysis to evaluate the sustainability of benthic macroinvertebrate communities in these water bodies. The sediment triad approach evaluates three elements of a benthic community:

field assessment of benthic macroinvertebrates;

sediment chemistry measurements;

sediment toxicity testing using indicator benthic macroinvertebrates.

Field assessment of benthic macroinvertebrate community

Effects will be evaluated by comparing the composition and abundance of benthic macroinvertebrates within Dead Creek at different levels of concentrations of COECs in sediments (generally following EPA Rapid Bioassessment Level I Protocols in the field). These comparisons will help to estimate if there is a level above which effects are evident. Data from the reference areas will help to support the assessment because these reflect conditions in water bodies unaffected by site contaminants. If there are observable reductions in the abundance of benthic macroinvertebrates, we will assess the significance of this for the fish species that rely upon the macroinvertebrates for food as this is the basis for the assessment. This will be accomplished by relating the abundance and biomass of benthic macroinvertebrates to their production, and ultimately to the potential production of fish, using available production:biomass ratios from the literature.

Sediment chemical measurements

Concentrations of COECs in sediment will be compared to sediment benchmarks to judge whether adverse biological effects to benthic macroinvertebrates are plausible. The USEPA compares sediment chemical measurements to Effect Range-Low (ERL) values and Effect Range-Median (ERM) values (Long and Morgan, 1990). However, sediment concentrations which exceed ER-Ls and/or ER-Ms do not necessary indicate that adverse effects to benthic macroinvertebrates have occurred. The USEPA's sediment triad approach uses multiple lines of evidence to assess if benthic macroinvertebrates are adversely affected by sediment-associated contaminants.

The USEPA has published an ECO-UPDATE entitled: "Ecotox Thresholds" that includes COEC-specific sediment benchmarks. If an Ecotox Threshold value is available for a COEC, the concentration of the COEC in sediment will be compared its respective Ecotox Threshold value. When specific benchmarks are not available and when appropriate, USEPA has suggested that appropriate extrapolations between related species can be used.

Sediment toxicity testing

The assessment will use laboratory sediment bioassays conducted on sediments from Dead Creek and the reference area to evaluate the potential effects of whole sediment on representative benthic macroinvertebrates. The toxicity of the sediment will be compared to that of the standard control sediment used by the laboratory as part of the laboratory's standard operating procedures. Statistically significant decreases in survival and/or growth relative to controls will be considered a COEC-related effect when they can be related to exposures associated with COECs in the sediments.

4.3.2 Measures of Effects Associated with Assessment Endpoint 2

Survival, growth, and reproduction of local populations of aquatic wildlife populations represented by bald eagles, mallard duck, great blue heron, muskrat, and river otter or racoon (incorporates the assessment of benthic macroinvertebrates)

The assessment will use six measures of effects (some species-specific) to evaluate risks to the wildlife assessment endpoint. Food-chain modeling will estimate exposure to the four wildlife species.

Wildlife either sighted during prior site visits or likely to occur based on the evaluation of habitats was used to identify representative wildlife species.

Table 2. Representative Aquatic Wildlife Species Proposed for Assessing Risks of COECs to Wildlife.

Species	Feeding Guild	Primary Habitat	Use in ERA
Bald Eagle	Eats fish and other small animals	Aquatic	Evaluate exposure to COECs in aquatic food webs
Great Blue Heron	Eats fish and other small animals	Aquatic	Evaluate exposure to COECs in aquatic food webs
Mallard Duck	Eats plants and macroinvertebrates	Aquatic	Evaluate exposure to COECs in aquatic plants and macroinvertebrates
Muskrat	Eats plants and some macroinvertebrates (e.g., clams)	Aquatic	Evaluate exposure to COECs in aquatic plants and in macroinvertebrates
River otter or raccoon	Eats fish, other small animals and some macroinvertebrates	Aquatic	Evaluate exposures to COECs in fish and macroinvertebrates

The assessment will use exposure models to evaluate different routes of exposure including ingestion of water, sediment and food (plants, benthic macroinvertebrates and fish). This subsection describes the measures of effects and the general model used to evaluate exposures.

Measure of effect 2a: Wildlife species composition and habitat use.

Purpose and Rationale. The measure of effect directly examines the receptors – wildlife – to estimate if they are using the various sectors of Dead Creek. The assessment is a measure of the degree to which local and migratory wildlife use the habitat and the extent to which it supports their needs.

Approach: The assessment will compare the composition and habitat use by wildlife to observations of species composition of wildlife and their use of a reference area. A wildlife biologist will make these observations This type of survey is qualitative. The strength of the analysis is that it indicates whether Dead Creek can support wildlife species comparable to unaffected reference areas. However, because of the qualitative nature of the observations and the high natural variability that can exist in wildlife populations, direct observations may not reveal effects.

Measure of effect 2b: Concentrations of COECs in aquatic and marsh plants.

This measure of effect will be conducted within Dead Creek Segments B to F, and M and the reference areas.

This plan recommends collecting aquatic and marsh plants for analysis of COECs because some species of wildlife using Dead Creek and wetlands eat aquatic and marsh plants. This is a potentially complete exposure pathway for wildlife. The QAPP/FSP describes the details of the aquatic and marsh plant collection and analysis.

Purpose and Rationale. The assessment will compare measures of COECs in submerged aquatic and emergent marsh vegetation within Dead Creek and a reference water body. Waterfowl graze on aquatic plants. Herbivorous mammals such as the muskrat eat aquatic and emergent vegetation in wetlands. If plants take up metals and PAHs from the water or sediments, waterfowl and herbivorous mammals could be exposed to these COECs in their diet.

As the QAPP/FSP indicates, fruiting bodies/leaves and roots from aquatic plants and emergent plants will be composited separately.

Approach: The endpoint will be evaluated in multi-pathway exposure models for the mallard and the muskrat that considers sediment, water, and food. Exposures to water fowl and herbivorous mammals within the Dead Creek sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas. The COEC concentrations measured in submergent aquatic plants will be used to evaluate potential dietary exposures to the mallard, which graze on aquatic plants. The COEC concentrations measured in submergent and emergent plants will be used to evaluate potential dietary exposures to the muskrat, which graze on greens.

Measure of effect 2c: Concentration of COECs in surface waters.

Purpose and Rationale. Many wildlife species will use Dead Creek and associated wetlands as a drinking water source. The presence of COECs in water could be a source of exposure to these species. This measure of effect examines this potential route of exposure.

Approach: This endpoint will be evaluated in multi-pathway exposure models for the mallard and the great blue heron that considers sediment, water, and food. The assessment will compare exposures to these selected representative species within the Dead Creek sectors to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Measure of effect 2d: Concentration of COECs in fish.

Purpose and Rationale: Some wildlife species such as the bald eagle, the great blue heron eat primarily fish. This measure of effect evaluates this potential route of exposure.

Approach. Fish will be collected and analyzed for COECs. The COEC levels measured in fish will be used in the multi-pathway exposure model for the bald eagle and the great blue heron that considers sediment, water, and food. Exposures to the bald eagle and the great blue heron within the Dead Creek Sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

Measure of effect 2e: Concentration of metals and PAHs in benthic macroinvertebrates (including crayfish).

Purpose and Rationale. Waterfowl (such as the mallard) and mammals (such as the muskrat) eat benthic macroinvertebrates as a portion of their diet. This measure of effect evaluates this potential route of exposure.

Approach: Benthic macroinvertebrates and crayfish will be collected and analyzed for COECs. The COEC levels measured in benthic macroinvertebrates will be used in a multi-pathway exposure model for the mallard and for the muskrat that considers sediment, water, and food. Exposures to water-fowl and mammals within the Dead Creek Sectors will be compared to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

4.3.3 Measures of effects Associated with Assessment Endpoint 3

Assessment Endpoint 3 is survival, growth, and reproduction of individuals within the local bald eagle population in Creek Sectors B through F, and M.

Measure of effect 3a: Concentration of COECs in forage fish for use in evaluating exposure via the food chain.

Purpose and Rationale. Bald eagle may use fish in Dead Creek and associated wetlands as food. The presence of COECs in fish could be a source of exposure to this species. This measure of effect examines this potential route of exposure.

Approach: This endpoint will be evaluated in a an exposure model for the bald eagle. The assessment will compare exposures to: 1) appropriate NOAEL and LOAEL values, and 2) exposures that occur in reference areas.

4.3.4 Measures of Effect Associated with Assessment Endpoint 4

Measure of effect 4a: COEC concentrations in soil samples from Creek bank and floodplain as compared to applicable soil screening levels for protection of wildlife, plants, and soil dwelling invertebrates.

Purpose and Rationale. Soil concentrations provide a measure of exposure, and screening level criteria indicate levels above which effects may occur. This measure of effect will evaluate the potential for soil concentrations of COECs in Dead Creek banks and floodplains to cause adverse effects.

Approach: The assessment will compare measured concentrations of total contaminant concentrations in soils to existing (e.g. Oak Ridge National Laboratory Toxicological Benchmarks for Wildlife; Oak Ridge National Laboratory Toxicological Benchmarks for Screening Potential Effects on Terrestrial Plants; Oak Ridge National Laboratory Toxicological Benchmarks for Contaminants of Potential Concern for Effects on Soil and Litter Invertebrates and Heterotrophic Processes).

We will also use any terrestrial soil screening concentrations or benchmarks developed by the time the proposed work occurs.

4.4 Structure of Wildlife Exposure Models

The general form of the wildlife exposure model is:

Exposure Dose (oral) = $[Conc_{food} * Ingest_{food}] + [RAF * Conc_{soil} * Sediment_{diet} * Ingest_{food}]$

Where:

Exposure Dose (oral) = dose of a COEC in ug/g-day

$Conc_{food}$ = concentration of the COEC (ug/g) in the food (measured or estimated); this is the average and the 95 % CL concentration in the relevant exposure zone – an area determined by the size and locations of foraging areas. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas. We will also use the 95% CL and calculate risk from this exposure separately.

$Ingest_{food}$ = amount of food ingested per day normalized to body weight (g/g-day) and usually expressed in terms of wet weight/wet weight

RAF – relative availability factor for COECs in sediment via incidental ingestion of sediment

$Conc_{sediment}$ = concentration ug/g in the relevant exposure zone; this is estimated as an average concentration in the exposure zone for chronic exposure and effects, and as upper bound (e.g., maximum or hot spot concentrations) for evaluation of short-term or acute exposures. The average is the appropriate statistic because ecological receptors integrate exposure over their foraging areas.

$Sediment_{diet}$ = fraction of sediment in the diet; the product of this number and $Ingest_{food}$ yields an estimate of the amount of sediment that is incidentally ingested

Sediments that are collected within shallow water (< 3 feet deep) in open water areas of Dead Creek, sediments along the bank, and soils adjacent to the creek (where available) will be used to assess incidental sediment ingestion. Sediments collected from the top 5 cm will be considered accessible to aquatic wildlife.

Because exposures to COECs associated with diet and sediment will be higher than surface water ingestion, this exposure pathway will not be estimated within the model. However, we will compare National Recommenced Water Quality Criteria for the protection of wildlife to surface water concentrations where such data and corresponding criteria are available.

Model Application

The model will be applied in several ways:

1. Acute exposure: The potential for acute exposure is considered without incorporating information on foraging area. The rationale for this is that an acute exposure involves a short-term feeding or exposure event that does not have to be averaged over the foraging area. When calculating the potential for acute exposure, maximum concentrations are used within the geographically defined local population or Threatened and Endangered species. Locations that exceed exposure concentrations that could result in acute toxic effects are identified.

2. Chronic exposure to individuals: The potential for chronic exposure to individuals is considered by determining both the maximum concentration and calculating an average concentration of food and sediments at spatial scales defined by the foraging areas of the species. For example, exposure concentrations for a species with a foraging area of 10 ha would be determined by averaging the food and sediments concentrations within this spatial scale. A species with a foraging area of 0.1 ha would have an averaging area that is 100 times less.

3. Chronic exposure to the population. The local population as defined above is made up of a number of individuals. Because the success of the local population is not dependent on the risk to any particular individual, a wildlife exposure model will also be used to estimate chronic exposures to individuals throughout the local population. These estimates take into account the spatial distribution of COECs, the foraging areas of the individuals within the species, and possible spatial distributions of these individuals within the area that defines the local population. Results are used to estimate risks as a percentage of the local population. The local population is confined to individual animals that use Dead Creek and its associated wetlands and small ponds.

4. Acute and chronic exposures to the Bald Eagle. Because the Bald eagle is rare and the risk to the individual is considered, the wildlife exposure model will also be used to estimate exposures to the individual.

5.0 RISK CHARACTERIZATION

Risk results will be presented as calculated Hazard Quotients as well as other measures (e.g., presence of toxicity). These results will be incorporated into the weight of evidence approach in the form of graphs and tables and will be explained in narratives. Graphs will be used to illustrate the four factors that contribute to the weight of evidence evaluation.

5.1 Use of Hazard Quotients

Because the Hazard Quotient will be one of the more common methods used to express results, it is explained below. The method simply involves comparisons of exposure concentrations for COECs to concentrations at which effects are judged:

$$\text{Hazard Quotient} = \frac{\text{Concentration}_{\text{exposure}}}{\text{Concentration}_{\text{effects}}}$$

where:

$\text{Concentration}_{\text{exposure}}$ = the concentration or dose to which an organism is exposed

$\text{Concentration}_{\text{effects}}$ = the concentration or dose at or above which effects may occur

If the Hazard Quotient exceeds "1", there is a potential for an effect. To some extent, the higher the number above "1", the more likely that an effect would occur. Calculations of Hazard Quotients need to take into account spatial and temporal factors inasmuch as these are related to the effect that might occur to populations of biota. The COECs may have additive effects on organisms, and these will be evaluated by summing across compounds grouped according to the specific toxicological effect they may have.

5.2 Toxicity Reference Values for Wildlife

TRVs used in the toxicity quotient's denominator represent chronic oral No Observed Adverse Effect Levels (NOAELs). A TRV will be expressed as mg of COEC / kg Body Wt. of the test animal / day. TRVs will be selected from published studies cited in the following sources:

> United States Fish and Wildlife Service (USFWS) biological reports that review and summarize literature on the ecological and toxicological aspects of COECs with special reference to fish and wildlife.
>
> Toxicological animal studies cited in: Sample, B.E., D. M. Opresko and G.W. Suter II, 1996, *Toxicological benchmarks for wildlife: 1997 revision*, Oak Ridge National Laboratory, Oak Ridge, Tennessee;

The Waterways Experimental Station on-line database;

The Society of Environmental Toxicology and Chemistry's recently published database of residual effect levels (Jarvinen and Ankley, 1999);

Computer on-line data bases, such as Toxline, Biosis, Wildlife Fisheries Review, Pollution Abstracts, and Environmental Abstracts.

When reviewing the toxicological literature and selecting the most appropriate TRV, several factors will be considered including:

- Taxonomic relationship between the test animal and the indicator species;
- Use of laboratory or domesticated animals;
- Ecological relevance of the study endpoints—Studies with chronic toxicity endpoints, such as reproductive, growth, behavior and developmental endpoints, are targeted. Sensitive endpoints, such as reproductive or developmental toxicity, are preferentially selected because they are closely related to the selected assessment endpoints (*e.g.*, population declines);
- Toxicological studies in which the chemical was administered through the diet of the test species are preferred over studies using other oral dosing methods, such as gavage; and
- Long-term studies representing chronic exposure are preferentially selected.

Dietary concentrations (mg/kg diet) cited in the reference study will be converted to mg/kg BW/day. If the daily dose reported in the selected study is a Lowest Adverse Effect Level (LOAEL), then the LOAEL will be converted to a NOAEL using a factor of 10. Interspecies correlations will be considered.

If toxicological animal studies are not available for a particular COEC, then QSAR will be considered and a surrogate chemical will be selected when possible. If the COEC can not be assessed quantitatively, then the risk to the COEC will be qualitatively discussed.

Species specific toxicity factors may not be available for all COEC. In such cases, the assessment will apply the following sequential steps to develop a toxicity factor.

- Use a toxicity value or criterion for the protection of exposed organisms, if an appropriate state or federal agency has proposed it.

- If criteria are unavailable, but appropriate data are available on NOAELs for the receptor species, use the lowest NOAEL for the receptor species.

- If an appropriate NOAEL is unavailable for the receptor species, use a NOAEL for a species which is phylogenetically similar (within the same genera or family) and ecologically similar to the selected receptor species (e.g. from the same family of birds or mammals).

- If an appropriate NOAEL is unavailable for a phylogenetically similar species, extrapolate from an appropriate NOAEL value for other species (as closely related as possible) by dividing by 5 to account for extrapolations between families and by 10 to account for extrapolations between orders. Use the lowest appropriate NOAEL whenever several studies are available.

- In the absence of an appropriate NOAEL, if a LOAEL is available for a phylogenetically similar species, divide it by 10 to account for a LOAEL to NOAEL conversion. The LOAEL to NOAEL conversion is similar to EPA's derivation of human health RfD values, where LOAEL studies are adjusted by a factor of 10 to estimate NOAEL values.

- For calculating chronic toxicity values from data for sub-chronic tests, divide the resultant LOAEL or NOAEL by an additional factor of 10. This is consistent with the methodology used to derive human RfD values. EPA has no clear guidance on the dividing line between subchronic and chronic exposures. The present risk assessment follows recently developed guidance (Sample et al., 1996) which considers 10 weeks to be the minimum time for chronic exposure of birds and 1 year for chronic exposure of mammals. In addition to duration of exposure, the time when exposure to contaminant occurs is critical.

- In cases where NOAELs are available as a dietary concentration (e.g., mg contaminant per kg food), calculate a daily dose for birds or mammals based on standard estimates of food intake rates and body weights (USEPA, 1993c).

6.0 DISCUSSION OF UNCERTAINTIES AND EXPOSURE ASSUMPTIONS

Sources of uncertainty and variability within the ERA will be identified. The impact associated with these uncertainties will be qualitatively addressed. Sensitivity analyses will be conducted for the important exposure parameters that are used in the wildlife exposure models and for the TRVs that are used to determine risk to the representative wildlife species.

7.0 REFERENCES

Nagy, K.A., (1987). "Field Metabolic Rate and Food Requirement Scaling in Mammals and Birds". Ecological Monographs, 57(2), 1987, pp 111-128

US Environmental Protection Agency . (1993). Wildlife Exposure Factors Handbook Volume I. Washington D.C: Office of Research and Development; USEPA Report no. EPA/600/R-93/187a

Beyer, W.N., E.E. Connor, and S. Gerould. (1994). Estimates of soil ingestion by wildlife. J. Wildl. Manage. 58: 375-382.

Chapman, J.A., and G.A. Feldhamer. 1982. *Wild Mammals of North America*. Johns Hopkins University Press, Baltimore, MD and London.

Harris, C. J. (1968) Otters: a study of the recent Lutrinae. London, U.K.: Weidenfield & Nicolson.

Jarvinen, A.W. and G.T. Ankley, 1999. Linkage Effects to Tissue Residues: Development of a Comprehensive Database for Aquatic Organisms Exposed to Inorganic and Organic Chemicals. Pensacola FL, Society of Environmental Toxicology and Chemistry Press, 364pp.

Svihla, A.; Svihla, R. D. (1931) The Louisiana muskrat. J. Mammal. 12: 12 –28

U.S. Environmental Protection Agency. (1993). Wildlife Exposure Factors Handbook. U.S. EPA Office of research and Development. EPA/600/R-93/187a.

EE/CA and RI/FS Support Sampling Plan

Sauget Area 1

Sauget and Cahokia, Illinois

Volume 1D

Engineering Evaluation/Cost Analysis Work Plan

June 25, 1999

Submitted To:

U.S. Environmental Protection Agency
Chicago, Illinois

Submitted By:

Solutia Inc.
St. Louis, Missouri

ENGINEERING EVALUATION/COST ANALYSIS
WORK PLAN
SAUGET AREA 1 SITE
SAUGET AND CAHOKIA, ILLINOIS

June 25, 1999

Prepared for:

Solutia Inc.
10300 Olive Boulevard
St. Louis, Missouri 63141

Prepared by:

ROUX ASSOCIATES, INC.
1110 NASA Road One, Suite 207
Houston, Texas 77058
(281) 335-4000

CONTENTS

TABLES

1.0 INTRODUCTION

On January 21, 1999, Monsanto Company and Solutia Inc. (Respondents) entered into an Administrative Order by Consent (AOC) with Region V of the United States Environmental Protection Agency (USEPA) with regards to the matter of environmental efforts to be completed at the Sauget Area 1 Site in Sauget and Cahokia, Illinois (Site). The Site is identified as six (6) source areas near, or adjacent to, Dead Creek known as Sites I, H, G, L, M and N. Also included in the Site are six (6) segments of Dead Creek sediments (CS) identified as CS-A through CS-F.

One of the requirements of the AOC, identified in Section V, is to prepare and implement an Engineering Evaluation/Cost Analysis (EE/CA) at the Site. The main purpose of the EE/CA is to evaluate removal options for soil, sediments, surface water, air, and leachate (ground-water seepage at an elevation greater than the uppermost water-bearing zone) that may pose a threat to human health and the environment. In addition, the AOC requires that a Remedial Investigation/Feasibility Study (RI/FS) be performed simultaneously with the EE/CA to address ground-water at the Sauget Area 1 Site. These two investigations will be performed concurrently and are two key components of an overall effort to address impacted media at the Sauget Area 1 Site.

Pursuant to §300.415(b)(4)(i) of the National Contingency Plan (NCP), an EE/CA must be completed at all sites where non-time critical removal actions are required. The goals of the EE/CA are to identify the objectives of the removal action and to analyze the various alternatives that may be used to satisfy these objectives for cost, effectiveness, and implementability. Other goals of the EE/CA are to:

- Satisfy environmental review requirements for removal actions;
- Satisfy administrative record requirements for improved documentation of removal action selection; and
- Provide a framework for evaluating and selecting alternative technologies.

This EE/CA Work Plan is consistent with the requirements of the AOC and the Scope of Work (SOW). Furthermore, the USEPA document titled *Guidance on Conducting Non-Time Critical Removal Actions Under CERCLA* (EPA/540-R-93-057) was used as a guidance document during preparation of the Work Plan as required by the AOC. This EE/CA Work Plan was developed through a four-step process including:

- A detailed review of historical background information;
- Review of the AOC and attached SOW;
- Review of the above-referenced guidance document; and
- The identification of information and data needs.

The USEPA is responsible for satisfying community relations requirements relating to the EE/CA. At the conclusion of the EE/CA, the USEPA will be responsible for the selection of a removal action(s) for the media specified above, and will document the selection(s) in an Action Memorandum.

1.1 Objectives

The overall objective of the EE/CA process is to gather information from previous and current investigations, evaluate media in the areas of concern, and provide evaluations and comparisons that are sufficient to support an informed risk management decision regarding removal selection. The EE/CA will be based on site characterization information and data that will be collected as part of the field activities defined in the Support Sampling Plan (SSP).

The objectives of the EE/CA are to develop, screen, and to perform a detailed evaluation of removal alternatives for media in areas that are determined to be acutely hazardous to human health and the environment. The purpose of removal actions generally is to respond to a release or threat of a release of hazardous substances so as to prevent, minimize or mitigate harm to human health and the environment. As cited in the preamble to the NCP (FR 8695):

"Although all removals must be protective of human health and the environment within their defined objectives, removals are distinct from remedial actions in that they may mitigate or stabilize the threat rather than comprehensively address all threats at a site".

USEPA Region V intends to address all threats to human health and the environment (with the exception of ground water) at the Sauget Area I site using the EE/CA process.

The removal objectives will be consistent with all applicable or relevant and appropriate requirements (ARARs) to the extent practicable considering the urgency of the situation and scope of the removal.

The final objective of the EE/CA involves analyzing each selected removal alternative for effectiveness, implementability, and cost.

1.2 Organization of Work Plan

The organization of this Work Plan is as follows:

Section 1.0:	Introduction
Section 2.0:	Site Characterization
Section 3.0:	Identification of Removal Action Scope, Goals, and Objectives
Section 4.0:	Identification and Analysis of Removal Action Alternatives
Section 5.0:	Comparative Analysis of Removal Action Alternatives
Section 6.0:	Draft EE/CA Report Submission
Section 7.0:	Final EE/CA Report
Section 8.0:	Schedule

Section 1.0 discusses relevant background and regulatory information pertaining to the EE/CA, project objectives, and organization of the Work Plan. Section 2.0 discusses the proposed data collection tasks required to characterize the site, such as sampling, data collection and validation, and risk assessment. Section 3.0 discusses the potential scope,

goals, and objectives of removal actions. Section 4.0 describes the process of selecting removal alternatives. Section 5.0 presents the criteria for comparing removal alternatives. Sections 6.0 and 7.0 discuss preparation of the Draft and Final EE/CA Reports, and Section 8.0 presents the EE/CA submission schedule.

2.0 SITE CHARACTERIZATION

The initial task involved in implementation of an EE/CA is to characterize the site and surrounding area with data and information which have been previously collected. The EE/CA will summarize available data on the physical, demographic, and other characteristics of the Site and surrounding areas. The Site characterization discussion will concentrate on those characteristics necessary to evaluate and select an appropriate removal action. Data to be collected for the EE/CA and incorporated into this section will come from the SSP and RI, and past investigations. The Site characterization will be broken down into the following sub-sections:

- Site Description and Background
- Previous Removal Actions
- Source, Nature, and Extent of Contamination
- Analytical Data
- Streamlined Risk Evaluation
- Ecological Risk Assessment

A discussion of each of these sub-sections is provided below.

2.1 Site Description and Background

This section will include current and historical information pertaining to the Site. The following types of information will be included, where available and as appropriate, to define the Site-specific conditions and the scope of the removal action:

- Site location and physical setting;
- Present and past facility operations and disposal practices (including incidents of fire and explosions);
- Geology/hydrology/hydraulics;
- Surrounding land use and populations;
- Sensitive ecosystems; and
- Meteorology/Climatology;

2.2 Previous Removal Actions

This section of the EE/CA will describe the previous removal actions at the Site. Previous information, if relevant, shall be organized as follows:

- The scope and objectives of the previous removal action(s);
- The amount of time spent on the previous removal action(s);
- The nature and extent of hazardous substances, pollutants, or contaminants treated or controlled during the previous removal action(s) (including all monitoring conducted); and
- The technologies used and/or treatment levels used for the previous removal action(s).

2.3 Source, Nature and Extent of Contamination

This section will summarize the available site characterization data for the Site, including the locations of the hazardous substances, pollutants, or contaminants; the quantity, volume, size or magnitude of the impacts; and the physical and chemical attributes of the hazardous pollutants or contaminants.

2.4 Analytical Data

The Analytical Data Section will present all quantifiable data collected for the EE/CA. This section will summarize existing data and include the additional data to be collected in accordance with the Support Sampling Plan. The data will include, soil, surface water, sediments, and air impact information.

2.5 Streamlined Risk Evaluation

In accordance with USEPA EE/CA guidance, a streamlined risk evaluation is a new type of evaluation, intermediate in scope between the limited risk evaluation undertaken for emergency removal actions and the conventional baseline assessment normally conducted for remedial actions. This evaluation will focus on actual and potential risks to the surrounding residential and industrial worker population from exposure to contaminated soils, sediments, surface water, air, and ingestion of potentially impacted biota in surrounding ecosystems. Reasonable maximum estimates of exposure and most likely estimates of exposure will be defined for both current land use conditions and reasonable future land use conditions. In general, this evaluation will use sampling data from the Site to identify the chemicals of concern, provide an estimate of how and to what extent people might be exposed to these chemicals, and provide an assessment of the health effects associated with these chemicals. The Streamlined Risk Evaluation for this study will focus on the specific areas that the removal action is intended to address. The evaluation will project the potential risk of health problems occurring if no cleanup action is taken at the Site and establish target action levels for both carcinogenic and non-carcinogenic constituents of concern (COCs). The risk evaluation will be conducted in general conformance with relevant aspects of the *Risk Assessment Guidance for Superfund (RAGS)*(EPA/540/1-89/002, December 1989).

A Human Health Risk Assessment Work Plan is included with this submittal (Volume 1B) that outlines the relevant requirements of the SOW and AOC and provides details that will be included in the Risk Assessment Report. The streamlined risk will be conducted by ENSR concurrent with the preparation of the EE/CA. The findings from the streamlined risk evaluation will be incorporated into the EE/CA written submittal and will be used in the overall evaluation of removal alternatives.

2.6 Ecological Risk Assessment

In accordance with the SOW and AOC, the EE/CA will include an ecological risk assessment. The risk assessment will be consistent with the USEPA guidance document: *Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments* (EPA/540/R/97/006, June 1997). Furthermore, the ecological risk assessment will contain the following information as required in the SOW:

- Hazard Identification (sources);
- Dose-Response Assessment;
- Conceptual Exposure/Pathway Analysis;

- Characterization of Site and Potential Receptors;
- Select Chemical, Indicator Species, and End Points;
- Exposure Assessment;
- Toxicity Assessment/Ecological Effects Assessment;
- Risk Characterization; and
- Identification of Limitations/Uncertainties.

An Ecological Risk Assessment Work Plan is included with this submittal (Volume 1C) that outlines the relevant requirements of the SOW and AOC, and provides details that will be included in the Ecological Risk Assessment Report. The ecological risk assessment will be conducted by Menzie-Cura & Associates, Inc. concurrent with the development of the EE/CA. The findings from the ecological risk assessment will be incorporated into the EE/CA written submittal.

3.0 IDENTIFICATION OF REMOVAL ACTION SCOPE, GOALS, AND OBJECTIVES

Identifying the scope, goals, and objectives for a removal action is a critical step in the EE/CA and in the conduct of non-time-critical removal actions. These objectives will meet specified cleanup levels while working within the statutory limits, and attaining ARARs to the extent practicable. Pursuant to the SOW, the following factors will be taken into consideration when determining the removal scope, goals, and objectives.

- Prevention or abatement of actual or potential exposure to nearby human populations, (including workers), animals, or the food chain from hazardous substances, pollutants, or contaminants;

- Prevention or abatement of actual or potential contamination of drinking water supplies and ecosystems;

- Stabilization or elimination of hazardous substances in drums, barrels, tanks, or other bulk storage containers that may pose a threat or release;

- Treatment or elimination of high levels of hazardous substances, pollutants, or contaminants in soils or sediments largely at or near the surface that may migrate;

- Elimination of threat of fire or explosion;

- Acceptable chemical-specific contaminant levels, or range of levels, for all exposure routes; and

- Mitigation or abatement of other situations or factors that may pose threats to public health, welfare, or the environment.

3.1 Determination of Removal Scope

The EE/CA will support the determination of the appropriate scope of the removal action by defining the broad scope and specific objectives and addressing the protectiveness of the removal action. The scope of the action could be, for example, site stabilization, source mitigation, or surface cleanup or "hot spot" removal of hazardous substances. The main emphasis will be on addressing media (except ground water) in all areas where acute and long-term chronic threats to human health and the environment are present.

3.2 Determination of Removal Schedule

A general schedule for any proposed removal activities will be developed, including both the start and completion time for the removal action, as required by the SOW.

4.0 IDENTIFICATION AND ANALYSIS OF REMOVAL ACTION ALTERNATIVES

Based on the analysis of the nature and extent of contamination and on the cleanup objectives that may be developed, as described in the previous section, a limited number of alternatives appropriate for addressing the removal action objectives will be identified and addressed. Whenever practicable, the alternatives will also consider the CERCLA preference for treatment over conventional containment or land disposal approaches.

Based on the available information, only the most qualified technologies that apply to the media or source of contamination will be discussed in the EE/CA. The use of presumptive remedy guidance, as appropriate and applicable to any of the disposal areas of the Sauget Area 1 Site, will also provide an immediate focus for the identification and analysis of alternatives. The guidance includes, but is not limited to: *Implementing Presumptive Remedies* (EPA 540-R-97-029, October 1997). Presumptive remedies involve the use of remedial technologies that have been consistently selected at similar sites or for similar contamination.

A limited number of alternatives, including any identified presumptive remedies, will be selected for detailed analysis. Each of the alternatives shall be described with enough detail so that the entire treatment process can be understood. Technologies that may apply to the media or source of contamination shall be listed in the EE/CA.

A preliminary list of alternatives that may be relevant for the Sauget Area 1 Site consists of, but is not limited to, treatment technologies, removal and off-site treatment/disposal, removal and an on-site treatment/disposal, and in-place containment of soils, sediments, and wastes. As part of any future remediation/removal activities in Dead Creek, alternatives will be evaluated that will prevent future flooding of residential/commercial areas within the Site area. A "no action" alternative will not be included for evaluation in the EE/CA in accordance with the SOW.

Removal action alternatives will be analyzed against three broad criteria: effectiveness, implementability, and cost. This analysis consists of analyzing each of the identified alternatives against the criteria, and subsequently determining if the alternative satisfies the removal action objectives that were previously identified. The three broad categories can be broken down into the subcategories as shown on Table 1 (Removal Alternatives Criteria) provided below. Table 1 was taken directly from the USEPA Guidance on Conducting Non-time Critical Removal Actions Under CERCLA (Exhibit 7, Objectives/Criteria to be Used in Comparative Analysis of Alternatives). These criteria are discussed below.

TABLE 1

REMOVAL ALTERNATIVES CRITERIA

❑ EFFECTIVENESS

- ❑ Protectiveness
  - ❑ Protection of public health and community
  - ❑ Protection of workers during implementation
  - ❑ Protection of the environment
  - ❑ Compliance with ARARs
- ❑ Ability to Achieve Removal Objectives
  - ❑ Level of treatment/containment expected
  - ❑ No residual effect concerns
  - ❑ Will maintain control until long-term solution implemented

❑ IMPLEMENTATIBILITY

- ❑ Technical Feasibility
  - ❑ Construction and operation considerations
  - ❑ Demonstrated performance/useful life
  - ❑ Adaptable to environmental conditions
  - ❑ Contributes to remedial performance
  - ❑ Can be implemented within 1 year
- ❑ Availability
  - ❑ Equipment
  - ❑ Personnel and services
  - ❑ Outside laboratory testing capacity
  - ❑ Off-site treatment and disposal; capacity
  - ❑ Post Removal Site Control (PRSC)
- ❑ Administrative Feasibility
  - ❑ Permits required
  - ❑ Easements of right-of-ways required
  - ❑ Impacts on adjoining property
  - ❑ Ability to impose institutional controls
  - ❑ Likelihood if obtaining an exemption from limits

❑ COST

- ❑ Capital Cost
- ❑ Post Removal Site Control (PRSC) costs
- ❑ Present Worth Cost

4.1 Effectiveness

The effectiveness of an alternative refers to its ability to meet the objective within the scope of the removal action. This Section of the EE/CA will evaluate each alternative against the scope of the removal action and against each specified objective for disposition of the wastes and the level of cleanup desired. These objectives will be discussed in terms of protectiveness of public health and the environment from short-term or acute threats and from chronic or long-term threats.

4.1.1 Overall Protection of Public Health and the Environment

The effectiveness of each alternative in protecting human health and the environment will be discussed in a consistent manner. Assessments conducted under other evaluation criteria, including long-term effectiveness and permanence, short-term effectiveness, and compliance with ARARs, where practicable, will be included in the discussion. The discussion will also focus on how each alternative achieves adequate protection and describe how the alternative will reduce, control, or eliminate risks at the Site through the use of treatment, engineering, or institutional controls. This evaluation will also identify any unacceptable short-term impacts.

4.1.2 Compliance with ARARs and Other Criteria, Advisories, and Guidance

Section 300.415(i) of the NCP requires that removal actions pursuant to CERCLA Section 106 attain ARARs under federal or State environmental laws or facility siting laws, to the extent practicable considering the urgency of the situation and the scope of the removal.

The detailed analysis shall summarize which requirements are applicable or relevant and appropriate to an alternative and describe how the alternative meets those requirements. A summary table may be employed to list potential ARARs. In addition to ARARs, other Federal or State advisories, criteria, or guidance to be considered (TBC) may be identified.

4.1.3 Long-Term Effectiveness and Permanence

This evaluation assesses the extent and effectiveness of the controls that may be required to manage risk posed by treatment residuals and/or untreated wastes at the Site. The following components will be considered for each alternative: Magnitude of risk, and adequacy and reliability of controls.

4.1.4 Reduction of Toxicity, Mobility, or Volume Through Treatment

As required by the USEPA, an evaluation based upon the following subfactors will be performed for each alternative:

- The treatment process(es) employed and the material(s) it will treat;
- The amount of the hazardous materials to be destroyed or treated;
- The degree of reduction expected in toxicity, mobility, or volume;
- The degree to which treatment will be irreversible;
- The type and quantity of residuals that will remain after treatment; and
- Whether the alternative will satisfy the preference for treatment.

4.1.5 Short Term Effectiveness

The short-term effectiveness criterion will address the effects of the alternative during implementation before the removal objectives have been met. Alternatives will also be evaluated with respect to their effects on human health and the environment following implementation. The following factors will be addressed, as appropriate, for each alternative:

- <u>Protection of the Community</u> – This factor will address any risk to the affected community that may result from implementation of the proposed action, whether from air quality impacts, fugitive dusts, transportation of hazardous materials, or other sources.

- <u>Protection of the Workers</u> – This factor will assess any threats to site workers and the effectiveness and reliability of protective measures that would be taken.

- Environmental Impacts – This factor evaluates the potential adverse environmental impacts from the implementation of each alternative. The factor also assesses the reliability of mitigation measures in preventing or reducing the potential impacts.

- Time Until Response Objectives Are Achieved – This factor estimates the time needed to achieve protection for the Site itself or for individual elements or threats associated with the Site.

4.2 Implementability

The implementability criterion addresses the technical and administrative feasibility of implementing an alternative and the availability of various services and materials required during its implementation. The following factors will be considered under this criterion.

4.2.1 Technical Feasibility

The EE/CA will assess the ability of the technology to implement the remedy. The following factors will be described:

- The degree of difficulty in constructing and operating the technology;
- The reliability of the technology;
- The availability of necessary services and materials;
- The scheduling aspects of implementing the alternatives during and after implementation;
- The potential impacts to the local community during construction operations; and
- The environmental conditions with respect to set-up and construction and operation.

Potential future remedial and/or removal actions, as well as the ability to monitor the effectiveness of the alternatives, will also be discussed.

- The potential impacts to the local community during construction operations; and
- The environmental conditions with respect to set-up and construction and operation.

Potential future remedial and/or removal actions, as well as the ability to monitor the effectiveness of the alternatives, will also be discussed.

4.2.2 Administrative Feasibility

The administrative feasibility factor evaluates those activities needed to coordinate with other offices and agencies. The administrative feasibility of each alternative will be evaluated, including the need for off-site permits, adherence to applicable non-environmental laws, and concerns of other regulatory agencies. Factors that will be considered include, but are not limited to, the following: statutory limits, permits, and waivers.

4.2.3 Availability of Services and Materials

The EE/CA will determine if off-site treatment, storage, and disposal capacity, equipment, personnel, services and materials, and other resources necessary to implement an alternative will be available in time to maintain the removal schedule. Several important availability factors are:

- Personnel and technology;
- Off-site treatment, storage, and disposal;
- Services and materials; and
- Prospective technologies.

4.3 Cost

Each alternative will be evaluated to determine its projected costs. The evaluation will compare each alternative's capital and operation and maintenance costs. The present worth of alternatives will be calculated. The following items will be presented:

- Direct Capital Costs – Costs for construction, materials, land, transportation, analysis of samples, and treatment.

- Indirect Capital Costs – Costs for design, legal fees, and permits.

- Long-Term Operation and Maintenance Costs – Costs for maintenance and long-term monitoring.

5.0 COMPARATIVE ANALYSIS OF REMOVAL ACTION ALTERNATIVES

After the potential removal action alternatives have been described and individually assessed against the evaluation criteria described previously, a comparative analysis will be conducted to evaluate the relative performance of each alternative in relation to each of the criteria. The purpose of this analysis will be to identify advantages and disadvantages of each alternative relatively, allowing for direct comparisons. The alternatives will also be compared against the removal action objectives.

6.0 DRAFT EE/CA REPORT SUBMISSION

At the conclusion of the field activities and individual studies that are described above, a comprehensive Draft EE/CA written report will be prepared and submitted to the USEPA and Illinois EPA. The EE/CA Report will include an Executive Summary which will provide a general overview of the contents of the EE/CA including a brief discussion of the Site and the current or potential threat(s) posed by Site conditions. The Executive Summary will also identify the scope and objectives of the removal action(s), as well as the removal action alternatives. Finally, this section of the EE/CA will provide information on the recommended removal action alternative.

This EE/CA document will also include details and results from the Support Sampling activities and the treatability studies, the Streamlined Risk Evaluation, and Ecological Risk Assessment. This document will discuss the removal action objectives and identification of the removal action alternatives. Finally, the selected removal action alternatives will be evaluated and compared based upon information and objectives that were developed during this study. Recommendations for the final selected removal alternative will be included in the Draft EE/CA document. The written Draft EE/CA document will have the following format:

1.0 Executive Summary
2.0 Site Characterization
  - 2.1 Site Description and Background
    - 2.1.1 Site Location and Physical Setting
    - 2.1.2 Present and Past Facility Operations and Disposal Practices (including incidents of fire and explosions)
    - 2.1.3 Geology/Hydrology/Hydraulics
    - 2.1.4 Surrounding Land Use and Population
    - 2.1.5 Sensitive Ecosystems
    - 2.1.6 Meteorology/Climatology
  - 2.2 Previous Removal/Remedial Actions
  - 2.3 Source, Nature, and Extent of Contamination

7.0 FINAL EE/CA REPORT

At the conclusion of all activities and subsequent to agency review of the draft EE/CA submittal, a Final EE/CA Report will be submitted to the USEPA and Illinois EPA that will include all information pertaining to this project.

8.0 SCHEDULE FOR EE/CA SUBMISSION

A schedule is provided in the SSP that constitutes Volume 1A of this submittal. Please refer to this schedule for information concerning all tasks involved with this project.

Respectfully submitted,

ROUX ASSOCIATES, INC.

Lance Richards

Lance W. Richards, P.E.

Senior Engineer

John R. Loper / TDF

John R. Loper, P.E.

Principal Engineer and Vice President

REFERENCES

OSWER, December, 1989. Risk Assessment Guidance for Superfund, Volume 1: Human Health Evaluation Manual, Part A, Interim Final. EPA/540/1-89/002 (Publication 9285.7-01B)

USEPA, October 1992. Guide for Conducting Treatability Studies Under CERCLA, Final EPA/540/R-92/071a

USEPA, August 1993. Guidance on Conducting Non-Time-Critical Removal Actions Under CERCLA. EPA 540-R-93-057

USEPA, June 1997. Ecological Risk Assessment Guidance for Superfund, Process for Designing and Conducting Ecological Risk Assessments. EPA/540/R/97/006

CFR, July 1997. National Oil an Hazardous Substances Pollution Contingency Plan (NCP), Part 300

USEPA, October 1997. Implementing Presumptive Remedies, A Notebook of Guidance and Resource Materials. EPA 540-R-97-029

USEPA, January, 1998. Risk Assessment Guidance for Superfund (RAGS). EPA 540/R/97/033

USEPA, January 21, 1999. Administrative Order by Consent with Respondents Monsanto Company and Solutia Inc. Sauget Area 1 Site, Sauget and Cahokia, Illinois

EE/CA and RI/FS Support Sampling Plan

Sauget Area 1

Sauget and Cahokia, Illinois

Volume 1E

Remedial Investigation/Feasibility Study Work Plan

June 25, 1999

Submitted To:

U.S. Environmental Protection Agency
Chicago, Illinois

Submitted By:

Solutia Inc.
St. Louis, Missouri

GROUND WATER
REMEDIAL INVESTIGATION/FEASIBILITY STUDY
WORK PLAN
SAUGET AREA 1 SITE
SAUGET AND CAHOKIA, ILLINOIS

September 8, 1999

Prepared for:

Solutia Inc.
10300 Olive Boulevard
St. Louis, Missouri 63141

Prepared by:

ROUX ASSOCIATES, INC.
1322 Space Park Drive, Suite A270
Houston, Texas 77058
(281) 335-4000

CONTENTS

1.0 INTRODUCTION

On January 21, 1999, Monsanto Company and Solutia Inc. (Respondents) entered into an Administrative Order by Consent (AOC) with Region V of the United States Environmental Protection Agency (USEPA) with regards to the matter of environmental efforts to be completed at the Sauget Area 1 Site in Sauget and Cahokia, Illinois (Site). The Site is identified as six (6) source areas near, or adjacent to, Dead Creek known as Sites I, H, G, L, M and N. Also included in the Site are six (6) segments of Dead Creek sediments (CS) identified as CS-A through CS-F.

One of the requirements of the AOC, identified in Section V, is to prepare and implement a Remedial Investigation/Feasibility Study (RI/FS) of the ground water underlying the Site. In addition, the AOC requires that an Engineering Evaluation/Cost Analysis (EE/CA) be performed simultaneously with the RI/FS to address the soil, sediments, surface water, and air at the Sauget Area 1 Site. The EE/CA will also address source area leachate where it is present at a higher elevation than the uppermost water-bearing zone. These two investigations will be performed concurrently and are two key components of an overall effort to address impacted media at the Sauget Area 1 Site. A Scope of Work (SOW) that outlines the RI/FS and the EE/CA to be performed at the Site, and divides the work into individual tasks, was included with the AOC as an attachment and is an integral part of the AOC.

The purpose of the RI is to evaluate the impact to ground water resulting from the disposal/deposition of materials in Sauget Area 1 and to assess the associated risk to human health and the environment. The FS will evaluate remedial alternatives for addressing the impact to human health and/or to the environment from affected ground water. This document presents the Work Plan for completing the RI/FS to be conducted at the Sauget Area 1 Site. The workplan to complete the EE/CA is provided in a separate document.

This RI/FS Work plan is consistent with the requirements of the AOC and the SOW. Furthermore, the USEPA document titled *Guidance on Conducting Remedial Investigations and Feasibility Studies Under CERCLA* (EPA/540/G-89/004) was used as a guidance document during preparation of the workplan, as required by the AOC. This RI/FS work Plan was developed through a four-step process including:

- A detailed review of historical background information;
- Review of the AOC and attached SOW;
- Review of the above-referenced guidance document; and
- The identification of information and data needs.

At the conclusion of the RI/FS, the USEPA will be responsible for the selection of a Site remedy for ground water and will document the selection in a Record of Decision (ROD) for ground water.

1.1 Objectives

In accordance with the AOC and SOW, an EE/CA and RI/FS Support Sampling Plan (SSP) has been prepared independently of the EE/CA and RI/FS Work Plans. The SSP will involve collecting numerous samples (ground-water samples in this case) for laboratory analysis and evaluating the resulting data to characterize the Site. The objective of the EE/CA and RI/FS Support Sampling is to further determine the extent of potential impact at the Site beyond that already defined by previous Site investigations. The SSP contains a description of equipment specifications, required analyses, sample types, and sample locations and frequencies.

As stated above, this RI/FS Work Plan addresses ground water at the Sauget Area 1 Site. The primary objective of the overall RI/FS process is to gather information and provide evaluations and comparisons which are sufficient to support an informed risk management decision regarding the remedy selection for ground-water measures. More specifically, the objectives of the RI are to collect all data and information that will be gathered during the implementation of the SSP and incorporate these data into a comprehensive Data Report, evaluate the hydraulic characteristics of the uppermost aquifer via ground-water modeling (including a fate and transport model if necessary), assess risk to human health and the environment, and evaluate potential technologies required to meet Site remedial action objectives.

The primary objective of the FS is to ensure that appropriate remedial alternatives are developed and evaluated such that relevant information concerning the remedial action options can be presented to the USEPA for selection of an appropriate remedy. The FS involves developing a list of remedial alternatives that will potentially protect human health and the environment based on information that was collected during the RI and previous investigations. These alternatives will be evaluated against nine criteria provided in 40 CFR 300.430 which are: overall protection of human health and the environment; compliance with Applicable or Relevant and Appropriate Requirements (ARARs); long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short term effectiveness; implementability; cost; State acceptance; and community acceptance. The SSP, RI and FS activities will be conducted concurrently so that data collected during the SSP can influence the development of remedial alternatives in the FS, which in turn may result in additional data needs which can be addressed in the remainder of the RI. As data are collected during the SSP, the need for additional sampling and data collection will be determined.

Additional objectives of the RI/FS are to satisfy all requirements stated in the AOC and attached Scope of Work, and appropriate guidance documents.

1.2 Organization of Work Plan

The organization of this Work Plan is as follows:

Section 1.0 Background Information
Section 2.0 Remedial Investigation
Section 3.0 Remedial Action Objectives
Section 4.0 Feasibility Study
Section 5.0 Progress Reports
Section 6.0 Schedule

Section 1.0 discusses relevant background and regulatory information pertaining to the RI/FS, project objectives, and organization of the Work plan. Section 2.0 discusses the RI and RI components such as the EE/CA and RI/FS Support Sampling Plan (SSP), data collection, data organization, and preparation of the RI report. Section 3.0 reviews the identification and documentation of remedial action objectives for the site. Section 4.0 discusses the FS and FS components such as analysis of RI data, evaluation and selection of remedial alternatives, and preparation of the draft and final FS report. Section 5.0 presents RI/FS progress report submittals. Finally, Section 6.0 discusses the project schedule.

2.0 REMEDIAL INVESTIGATION

This RI Work Plan, in conjunction with the Support Sampling Plan, provides a general explanation of the objectives of the study and the scope of work. Further, these Work Plans describe the study's purpose and goals while also serving as a valuable tool for assigning responsibilities and setting the project's schedule and cost.

2.1 Support Sampling Plan

As discussed above, a SSP has been prepared and will be conducted concurrent with the RI/FS in accordance with the AOC and SOW. The SSP was prepared by Solutia Inc. and is provided in Volume IA of this submittal. Most of the tasks included in this SSP are the initial tasks of an RI. Thus, these tasks will be referred to in this work plan and will be detailed in the Draft and Final RI Report. A summary of the ground-water related tasks to be completed in the SSP is provided below:

- Ground-Water Sampling in the Alluvial Aquifer, Bedrock (fill areas only), and Nearby Domestic Wells
- Discharge and Recharge Area Study
- Regional and Local Flow Direction and Quality Study
- Time-Series Ground-Water Sampling
- Slug Test Data Collection
- Grain Size Analyses
- Upgradient Ground-Water Data Collection

For each of the items listed above, a data gap study has been conducted to inventory current data and determine areas where additional data are needed for complete characterization. A complete description of each of the above tasks is provided in the SSP.

A background review of previous ground-water studies conducted at the Site and surrounding area was conducted during the preparation of the SSP. The results of this review are presented in Volume IA. The RI Report will incorporate this information and will include a thorough presentation of the existing ground-water data that have been developed at, and in the vicinity of, the Site from previous years of environmental investigations. All available data and facts about local and regional ground-water conditions and uses specific to the Site and surrounding area will be assembled.

A brief summary of the Site location, general site physiography, hydrology, and geology was also prepared as part of the SSP. The RI Report will provide tables displaying the frequency of detection, maximum, minimum, average and 95 percent confidence interval concentrations of compounds detected in ground water underlying the Site. Local ground-water recharge and discharge areas will be identified, and regional and local ground-water flow directions and quality will be discussed. State, county, city, and village records will be searched to identify any potential ground-water usage along Dead Creek.

The background review will also update disposal practice histories using information submitted in response to USEPA 103C and 104E requests. A list of chemicals handled by generators, transporters and disposers will be compiled for each fill area. Information on manifesting processes will also be extracted from the 104E responses and included in the RI/FS Report.

The SSP identifies data gaps and describes the additional data acquisition activities necessary to characterize ground water. The primary objective of the work defined in the SSP is to further determine the extent of ground-water impact at the Site beyond that already identified by previous Site investigations. The SSP includes information pertaining to the field investigation and technical approach, monitor well installations, sampling procedures, analytical parameters, and other relevant information.

Subsequent to approval of the SSP by the USEPA, the SSP will be implemented accordingly and consistent with the SSP schedule (included in the SSP). This task is referred to as Task 2 in the SOW. All field activities will be coordinated with the USEPA's Remedial Project Manager (RPM) during implementation, and the RPM will be provided with all laboratory data. The SSP will be performed by personnel from O'Brien & Gere on behalf of the Respondents. Complete details from the SSP and information pertaining to the field procedures, boring logs, analytical results, and subsequent findings will be incorporated into the RI Report.

2.2 Data Report

Subsequent to completion of all SSP field work and receipt of laboratory analytical results, the resulting data will be compiled into presentation format. This task is referred to as Task 3 in the SOW. According to the USEPA-approved schedule in the SSP, the Respondents will provide a report in tabular form, with corresponding figures, to the USEPA and Illinois EPA. The report will summarize the historic data review and results and findings from the SSP. The Data Report will be prepared by personnel from O'Brien & Gere on behalf of the respondents and will be included in the Final RI/FS Report.

2.3 Fate and Transport

To achieve the objectives of the RI/FS, definitive knowledge of the transport and fate of constituents in the subsurface is essential. Risk assessment and remediation of ground-water constituents require an understanding of how chemicals move through and interact with the subsurface environment. Results from the review of existing data, and from the SSP will be combined in the analyses of ground-water constituent fate and transport processes. If information on a constituent release is available, the observed extent of the constituent may be used in assessing the rate of migration and the fate of such constituent over the period between release and monitoring. Constituent fate and transport may also be estimated on the basis of site physical characteristics and source characteristics.

As appropriate, an analytical or numerical ground-water model will be used to better define the ground-water movement and trends at the Site. Models aid the data reduction process by providing the user with a structure for organizing and analyzing field data. Detailed numerical models (e.g., numerical codes) provide relatively greater accuracy and resolution because they are capable of representing spatial variations in site characteristics and irregular geometries.

Aquifer response parameters and geologic information from previous subsurface and hydrogeologic investigations will be integrated into the model to enable simulations of the uppermost water-bearing zone in static conditions and under given stresses (i.e., extraction or injection). The data obtained from these aquifer flow simulations will provide information pertaining to natural ground-water movement and ground-water reactions to stresses. This information will be used in support of the subsequent evaluations of the most effective remedial alternatives. This work will be performed by personnel from Roux Associates, Inc.

2.4 Data Validation

The ground-water laboratory results associated with RI sampling will be validated to determine the following:

- If the proper chain-of-custody was maintained;
- If proper methods were used;
- If holding times were met;
- If proper detection limits were achieved;
- If method blanks, field blanks, and/or trip blanks indicated any contamination;
- If relative percent differences (RPD) between a sample and it's duplicate were within control limits;
- If surrogate recoveries were within method established control limits;
- If any matrix interference was evident; and
- If laboratory control samples (LCS), LCS duplicate recoveries and RPDs were within laboratory control limits.

The data validation will be performed in accordance with USEPA SW846 methodologies. The data validation procedures are discussed in further detail in Volume 4 of the Support Sampling Plan Submittal.

2.5 Risk Assessment For Ground Water

A human health risk assessment (HHRA) will be conducted at the Site. The HHRA will be conducted separately from the SSP and other RI activities, but will be included in the Draft and Final RI Report. The HHRA will follow Task 4 Section 2.5 and Task 5 Section 2 of the SOW. The Human Health Risk Assessment Work Plan is presented in Volume 1B.

The HHRA will comply with USEPA guidance for conducting risk assessments including, but not limited to, the following:

- Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Parts A and D)(USEPA, 1989a and 1998a);

- USEPA Soil Screening Level: Technical Guidance Manual (USEPA, 1996a);

- Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. OSWER Directive 9285.6-03 (USEPA, 1991a);

- Exposure Factors Handbook (USEPA, 1997a); and

- Land Use in CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04 (USEPA, 1995).

The HHRA will consist of the following steps:

- Site Characterization –As described in Section 2.0 of the Risk Assessment Work Plan, the HHRA Report will discuss the Site and its environs, and present a conceptual Site model describing source areas, potential migration pathways, and potentially impacted media.

- Hazard Identification –As described in Section 3.0 of the Risk Assessment Work Plan, the HHRA Report will present a discussion of Site data, and a description of the constituents of potential concern (COPCs). Constituents of concern (COCs) will be identified as a subset of those COPCs. COCs represent compounds that may present risks in exceedance of the acceptable risk range of $1x10^{-6}$ to $1x10^{-4}$ for potential carcinogens and a target Hazard Index of 1.0 for noncarcinogens (that act on the same target organ), as identified in the AOC, SOW, and by the Illinois EPA (1998).

- Dose Response Assessment – As described in Section 4.0 of the Risk Assessment Work Plan, the HHRA Report will present a discussion of the dose-response assessment process. The dose-response assessment evaluates the relationship between the magnitude of exposure (dose) and the carcinogenic and noncarcinogenic effects. The most current USEPA verified dose-response values will be used when available.

- Exposure Assessment – As described in Section 5.0 of the Risk Assessment Work Plan, the HHRA Report will present a discussion of the exposure assessment process. The purpose of the exposure assessment is to provide a quantitative estimate of the magnitude and frequency of potential exposure to COPCs. Potentially exposed individuals, and the pathways through which those individuals may be exposed to COPCs are identified based on the physical characteristics of the Site, as well as the current and reasonably foreseeable future uses of the Site and surrounding area. The extent of a receptor's exposure is estimated by constructing exposure scenarios that describe the potential pathways of exposure to COPCs and the activities and behaviors of individuals that might lead to contact with COPCs in the environment.

- Risk Characterization – As described in Section 6.0 of the Risk Assessment Work Plan, the HHRA Report will present a discussion of the risk characterization process and uncertainties associated with the risk assessment process. Risk characterization combines the results of the exposure assessment and the toxicity assessment to derive Site-specific estimates of potentially carcinogenic and noncarcinogenic risks resulting from both current and reasonably foreseeable potential human exposures. Within any of the steps of the risk evaluation process described above, assumptions must be made due to a lack of absolute scientific knowledge. Some of the assumptions are supported by considerable scientific evidence, while others have less support. The assumptions that introduce the greatest amount of uncertainty in this risk evaluation are discussed in Section 6.0.

- Summary and Conclusions –The HHRA Report will present a summary of the results of the HHRA.

2.6 Draft RI Report

A Draft RI report for the Sauget Area 1 will be submitted to USEPA and Illinois EPA within 90 calendar days of submittal of the Data Report (Section 2.2 of this document). This task is referred to as Task 5 in the SOW. The Draft RI Report will be prepared by Roux Associates, Inc. and will summarize data collected during the SSP implementation and provide supplemental information gathered from past investigations. The RI Report will accurately describe the vertical and horizontal extent of ground-water impact and the concentrations of the constituents present. Data obtained during the fate and transport study and Human Health Risk Assessment will also be incorporated into the report. The Draft RI Report will have the following format:

- Site Background and Description
- Past Disposal Practices
- Site Characteristics
    - Geology
    - Hydrogeology
        - Local and Regional Ground-Water flow
        - Recharge and Discharge Areas
    - Hydrology
    - Meteorology/Climatology
    - Demographics and Land Use
    - Current and Past Ground-Water Usage in the Site Area.
- Summary Information on Investigations
    - Field Investigation and Technical Approach
    - Monitor Well Installation
    - Ground-Water Sampling
    - Chemical Analysis & Analytical Methods

    - Hydrogeological Assessment
- Nature and Extent of Contamination
    - Contaminant Sources
    - Ground-Water Contaminant Distribution and Trends
- Fate and Transport
    - Contaminant Characteristics
    - Ground-Water Fate and Transport Processes
    - Ground-Water Contaminant Migration Trends
    - Ground-Water Modeling
- Risk Assessment
- Summary and Conclusions

2.7 Final RI Report

Subsequent to the approval of the USEPA, a final RI Report will be prepared. This document will not be submitted as an individual document, but will be submitted along with the Final FS Report to produce the combined Final RI/FS Report.

3.0 REMEDIAL ACTION OBJECTIVES

Based on all of the information generated through this study, the evaluation of potential human health risks, and consideration of preliminary remediation goals, a list of site-specific remedial action objectives for ground water will be developed that will be protective of human health and the environment. These objectives will specify the contaminant(s) and media of concern, the exposure route(s) and receptor(s), and an acceptable contaminant level or range of levels for each exposure route.

Initially, preliminary remediation goals are developed based on readily available information, such as chemical specific Applicable or Relevant and Appropriate Requirements (ARARs), or other reliable information. Preliminary remediation goals will be modified, as necessary, as more information becomes available during the RI/FS. Final remediation goals will be determined when the remedy is selected. Remediation goals will establish acceptable exposure levels that are protective of human health and the environment and will be developed by considering the following:

- ARARs under federal environmental or State environmental or facility siting laws, if available, and the following factors:
    - For systemic toxicants, acceptable exposure levels will represent concentration levels to which the human population, including sensitive subgroups, may be exposed without adverse effect during a lifetime or part of a lifetime, incorporating an adequate margin of safety;
    - For known or suspected carcinogens, acceptable exposure levels are generally concentration levels that represent an excess upper bound lifetime cancer risk to an individual of between $1x10^{-6}$ and $1x10^{-4}$ using information on the relationship between dose and response.
    - Factors related to technical limitations such as detection/quantification limits for contaminants;

- Factors related to uncertainty; and

- Other pertinent information.

- Maximum Contaminant Level Goals (MCLGs), established under the Safe Drinking Water Act, that are set at levels above zero, will be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCLGs are relevant and appropriate under the circumstances of the release based on the NCP factors established in §300.400(g)(2). If an MCLG is determined not to be relevant and appropriate, the corresponding maximum contaminant level (MCL) will be attained where relevant and appropriate to the circumstances of the release.

- Where the MCLG for a contaminant has been set at a level of zero, the MCL promulgated for that contaminant under the Safe Drinking Water Act will be attained by remedial actions for ground or surface waters that are current or potential sources of drinking water, where the MCL is relevant and appropriate under the circumstances of the release based on the factors in §300.400(g)(2).

- Water quality criteria established under sections 303 or 304 of the Clean Water Act will be attained where relevant and appropriate under the circumstances of the release.

- An alternate concentration limit (ACL) may be established in accordance with CERCLA section 121(d)(2)(B)(ii).

4.0 FEASIBILITY STUDY

A Feasibility Study (FS) is typically conducted in three phases: development of alternatives, screening of alternatives, and the detailed analysis of alternatives. However, the specific point at which the first phase ends and the second begins is not distinct. Therefore, the development and screening of alternatives will be performed concurrently, if deemed necessary and appropriate. The NCP provides considerable latitude regarding the scope of this screening and development phase. As stated in the NCP §300.430(a)(1)(ii)(C): "Site-specific data needs, the evaluation of alternatives, and the documentation of the selected remedy should reflect the scope and complexity of the site problems being addressed." The NCP preamble emphasizes the principle of streamlining, which the USEPA applies in managing the Superfund program as a whole, and in conducting individual remedial action projects. In accordance with the principle of streamlining, an alternatives screening step may not even be deemed necessary prior to detailed analysis.

4.1 Development of Alternatives

The primary objective of this phase of the FS is to develop an appropriate array of options that will be analyzed more fully in the detailed analysis phase of the FS. Appropriate options to ensure the protection of human health and the environment may involve the complete elimination or destruction of hazardous substances in ground water at the Site, the reduction of concentrations of hazardous substances to acceptable health-based risk levels, the prevention of exposure to hazardous substances via engineering or institutional controls, or some combination of the above.

Alternatives for remediation are developed by assembling combinations of technologies into alternatives that address ground water on either a site-wide basis or for an identified area. This process consists of six general steps that are presented below:

- Develop remedial action objectives specifying the constituents of interest, exposure pathways, and preliminary remediation goals that permit a range of treatment and containment alternatives to be developed. The preliminary remediation goals are developed on the basis of chemical-specific ARARs, when available, other available information and site-specific risk-related factors (see Section 3.0).

- Develop general response actions for ground water defining containment, treatment, pumping, or other actions, singly or in combination, that may be taken to satisfy the remedial action objective for the Site.

- Identify areas to which general response actions might be applied, taking into account the requirements for protectiveness as identified in the remedial action objectives and the chemical and physical characterization of the Site.

- Identify and screen the technologies applicable to each general response action to eliminate those that cannot be implemented technically at the Site. The general response actions are further defined to specify remedial technology types (e.g., the general response action of treatment can be further defined to include chemical or biological technology types.)

- Identify and evaluate technology process options to select a representative process for each technology type retained for consideration. Although specific processes are selected for alternative development and evaluation, these processes are intended to represent the broader range of process options within a general technology type.

- Assemble the selected representative technologies into alternatives representing a range of treatment and containment combinations, as appropriate.

For those situations in which numerous remediation options are appropriate and developed, the assembled alternatives may need to be refined and screened to reduce the number of alternatives that will be analyzed in detail. This screening aids in streamlining the Feasibility Study process while ensuring that the most promising alternatives are being considered.

4.2 Screening of Alternatives

The purpose of the screening evaluation is to reduce the number of alternatives that will undergo a more thorough and extensive analysis. Thus, defined alternatives are evaluated more generally in this phase than during the detailed analysis; however, evaluations will be sufficiently detailed to the extent that the alternatives can be distinguished. The screening evaluation involves evaluating the defined alternatives against the short-term and long-term aspects of three broad criteria: effectiveness, implementability, and cost. During the detailed analysis, the alternatives will be screened against nine specific criteria and their individual factors rather than the three general criteria used in screening. Thus, a significant time savings can be realized in cases where numerous alternatives are identified if the screening process is carefully implemented. The three screening criteria are briefly discussed below:

- **Effectiveness Evaluation** – A key aspect of the screening evaluation is the effectiveness of each alternative in protecting human health and the environment. Each alternative will be evaluated as to its effectiveness in providing protection and the reductions in toxicity, mobility or volume that it will achieve. Both short- and long- term components of effectiveness will be evaluated; short-term referring to the construction and implementation period, and long-term referring to the period after the remedial action is complete.

- **Implementability Evaluation** – Implementability, as a measure of both the technical and administrative feasibility of constructing, operating, and maintaining a remedial action alternative, is used during screening to evaluate the combinations of process options with respect to conditions at the Site. Technical feasibility refers to the ability to construct, reliably operate, and meet technology-specific regulations for process options until a remedial action is complete; it also includes operation, maintenance, replacement, and monitoring of technical components of an alternative, if required, into the future after the remedial action is complete. Administrative feasibility refers to the ability to obtain approvals form other offices and agencies, the availability of treatment, storage, and disposal services and capacity, and the requirements for, and availability of, specific equipment and technical specialists.

- **Cost Evaluation** - The focus of this evaluation will be to make comparative estimates for alternatives with relative accuracy so that cost decisions among alternatives will be sustained as the accuracy of cost estimates improves beyond the screening process. The procedure used to develop cost estimates for alternative screening are similar to those used for the detailed analysis; the only differences are in the degree of alternative refinement and in the degree to which components are developed. Cost estimates for screening alternatives typically will be based on a variety of cost-estimating data. Bases for screening cost estimates may include cost curves, generic unit costs, vendor information, conventional cost-estimating guides, and prior similar estimates as modified by Site-specific information.

Alternatives with the most favorable composite evaluation of all factors will be retained for further consideration during the detailed analysis. Alternatives selected for further evaluation will, where practical, preserve the range of treatment and containment technologies initially developed. It is not a requirement that the entire range of alternatives originally developed be preserved if all alternatives in a portion of the range do not represent distinct viable options.

4.3 Detailed Analysis of Alternatives

4.3.1 Alternatives Array Document

Prior to proceeding with the detailed analysis of alternatives, an Alternatives Array Document will be prepared. This document will summarize the Remedial Action Objectives that were previously determined and list each of the initially selected technologies and provide the basis for selection. Furthermore, the document will provide details of the Alternative Screening Evaluation including the results of the study in a tabularized form. Finally, the document will propose a list of remedial alternatives for inclusion in the Detailed Analysis of Alternatives Study. This document will be included in the RI/FS Report.

The Alternatives Array Document will also summarize, in table format, the pertinent ARARs. These tables will be developed in accordance with USEPA guidance and existing State laws. The USEPA defines three types of ARARs:

- Chemical-specific
- Location-specific
- Action-specific

Chemical-specific ARARs include those laws and requirements that regulate the release of materials having certain chemical or physical characteristics, or materials containing specified chemical compounds, to the environment. These requirements generally establish health- or risk-based concentration limits or discharge limitations for specific hazardous substances. Maximum Contaminant Levels promulgated under the Safe Drinking Water Act, and the analogous Illinois Groundwater Quality Standards are important ARARs for this Site.

Location-specific ARARs are those requirements that relate to the geographical or physical position of the site, rather than to the nature of the contaminants or the proposed site remedial actions. These ARARs typically deal with environmentally sensitive areas (e.g., wetlands, flood plains, fault zones, etc.), and may limit the remedial actions that can be implemented, or may impose additional constraints on the remedial action.

Action-specific ARARs are requirements that define acceptable treatment and disposal procedures for hazardous substances. These ARARs generally set performance, design, or other similar action-specific controls or restrictions on particular kinds of activities related to management of hazardous substances or pollutants. These requirements are triggered by the particular remedial activities that are selected to achieve remedial action objectives.

4.3.2 Detailed Analysis Implementation

The Detailed Analysis will include: 1) a technical description of each alternative that outlines the strategy involved and identifies the key ARARs associated with each alternative; and 2) a discussion that profiles the performance of that alternative with respect to each of the nine evaluation criteria. This evaluation will include a table summarizing the results of this analysis. The nine evaluation criteria for Detailed Alternative Analysis are as follow:

Overall Protection Of Human Health and the Environment addresses whether or not the remedy provides adequate protection and describes how risks posed through each pathway are eliminated, reduced, or controlled through treatment, engineering controls, or institutional controls.

Compliance with ARARs addresses whether or not the remedy will meet all of the applicable or relevant and appropriate requirements of other Federal and State environmental statutes and/or provide grounds for invoking a waiver. A separate table will be included in the FS that details all Federal and State ARARs for ground water.

Long-Term Effectiveness and Permanence refers to the ability of the remedy to maintain reliable protection of human health and the environment over time once cleanup goals have been met.

Reduction of toxicity, mobility, or volume through treatment is the anticipated performance of the treatment technologies a remedy may employ.

Short-Term Effectiveness addresses the period of time needed to achieve protection and any adverse impacts on human health and the environment that may be posed during the construction and implementation period until cleanup goals are achieved.

Implementability is the technical and administrative feasibility of the remedy, including the availability of materials and services needed to implement a particular option.

Cost includes estimated capital and operation and maintenance costs, and net present worth costs.

State Acceptance The USEPA will consider and address Illinois EPA acceptance of an alternative when making a recommendation and in the final selection of a remedy in the ROD.

Community Acceptance The USEPA will consider and address community acceptance of an alternative when making a recommendation and in the final selection of a remedy in the ROD.

The criteria listed above will be used to effectively compare each of the technologies. These criteria are categorized into three groups listed below:

- **Threshold criteria.** Overall protection of human health and the environment and compliance with ARARs (unless a specific ARAR is waived) are threshold requirements that each alternative must meet in order to be eligible for selection.

- **Primary balancing criteria.** The five primary balancing criteria are long-term effectiveness and permanence; reduction of toxicity, mobility, or volume through treatment; short-term effectiveness; implementability; and cost.

- **Modifying criteria.** State and community acceptance are modifying criteria that the USEPA will consider in remedy selection Section 121 of Comprehensive Environmental Response, Compensation, and Liability Act (CERCLA) provides for state involvement in remedy selection, while Sections 113 and 117 provide for public participation during remedy selection. These two criteria are applied to the remedy selection process following receipt of comments on the FS (for support agency acceptance) and after the public comment period following publication of a Proposed Remedial Action Plan. Therefore, these modifying criteria will not be addressed specifically in the FS.

4.4 Draft FS Report

At the conclusion of the activities described previously, a Draft FS Report will be prepared and submitted to the USEPA and Illinois EPA. This document will list the selected Remedial Action Objectives, include all details pertaining to the selection of remedial alternatives, preliminary evaluation and screening of alternatives, and detailed evaluation and selection of alternatives. Furthermore, recommendations for the final selected remedial alternative will be included in the Draft RI/FS document. Correspondence from the regulatory agencies will be provided in the Appendices to the FS Report.

4.5 Final RI/FS Report

At the conclusion of all activities and subsequent to agency review of the draft RI and FS submittals, a Final RI/FS Report will be submitted to the USEPA and Illinois EPA that will include all information pertaining to this project.

5.0 PROGRESS REPORTS

Written progress reports will be submitted to the USEPA and Illinois EPA concerning activities undertaken pursuant to the AOC and SOW, beginning 30 calendar days subsequent to the effective date of the AOC. These reports will continue until termination of the Order, or unless otherwise specified in writing directly from the RPM. These reports will describe significant developments during the preceding reporting period, including the work performed and any problems encountered, analytical data received during the reporting period, and developments anticipated during the next reporting period.

6.0 SCHEDULE

A schedule is provided in the SSP (Volume 1A of this submittal).

Respectfully submitted,

ROUX ASSOCIATES, INC.

Lance W. Richards, P.E.

Senior Engineer

John R.Loper, P.E.

Principal Engineer and Vice President

REFERENCES

USEPA, October 1988. Guidance for Conducting Remedial Investigations and Feasibility Studies Under CERCLA. EPA/540/G-89/004

USEPA, 1989a and 1998a, Risk Assessment Guidance for Superfund: Volume 1 – Human Health Evaluation Manual (Parts A and D);

USEPA, 1991a, Human Health Evaluation Manual Supplemental Guidance; Standard Default Exposure Factors. OSWER Directive 9285.6-03

USEPA, 1992a. Evaluation of Ground-Water Extraction Remedies: Phase II, Volume II 1-Summary Report. Office of Emergency and Remedial Response, Washington, D.C. USEPA Publication 9355.4-05.

USEPA, 1992b. Evaluation of Ground-Water Extraction Remedies: Phase II, Volume 2 – Case Studies and Updates. Office of Emergency and Remedial Response, Washington, D.C. USEPA Publication 9355.4-05A.

USDOE, December 1993. Environmental Guidance – Remedial Investigation/Feasibility Study (RI/FS) Process, Elements and Techniques Guidance

USEPA, 1995, Land Use in CERCLA Remedy Selection Process. OSWER Directive No. 9355.7-04

USEPA, 1996a, Soil Screening Level: Technical Guidance Manual

USEPA, 1997a, Exposure Factors Handbook

CFR, July 1997. National Oil and Hazardous Substances Pollution Contingency Plan (NCP), Part 300

USEPA, October 1997. Implementing Presumptive Remedies, A Notebook of Guidance and Resource Materials. EPA 540-R-97-029

USEPA, January 21, 1999. Administrative Order by Consent with Respondents Monsanto Company and Solutia Inc. Sauget Area 1 Site, Sauget and Cahokia, Illinois

SOLUTIA

Applied Chemistry, Creative Solutions

August 13, 1999

To: Mr. Michael McAteer
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Mr. Thomas Martin
Associate Regional Counsel
U. S. EPA - Region 5
77 West Jackson Boulevard (C-14J)
Chicago, Illinois 60604-3590

Ms. Candy Morin
Illinois Environmental Protection Agency
1021 North Grand Avenue East,
P. O. Box 19276
Springfield, Illinois 62794-9276

Re: Support Sampling Plan for Sauget Sites Area I January 21, 1999 Administrative Order by Consent

- **Revisions to Solutia's June 25 1999 Support Sampling Plan Submittal**

Mr. McAteer, Mr. Martin and Ms. Morin,

Enclosed are revisions to Solutia's June 25, 1999 Support Sampling Plan ("SSP"). These revisions are responsive to the Agencies' July 16, 1999 comments (with one exception[1]) on the June 25, 1999 Revised SSP submittal, consistent with Solutia's understanding of the agreements reached in the July 27, 1999 meeting in Collinsville to discuss the

[1] The one exception is Weston's comment that the ecological samples be collected after completion of sediment sampling analyses. This approach for selection of ecological sampling locations will extend the project schedule by 8 months (see schedule in SSP). Based on the Agency's expressed strong desire to complete the Work in as short a time as is reasonable, Solutia recommends and intends to implement the 18 month schedule (also included in the SSP), which precludes the sequencing of ecological sampling after sediment analyses completion. The 18 month schedule requires that the ecological sampling begin in September and end in October, 1999. Sediment sample results will not be completed until January 2000. If ecological sampling followed receipt of these results, this activity could not begin until May/June 2000 - the next growing season.

comments. Since the affected number of pages were relatively small, only the revised pages are included in this transmittal (along with a guide for insertion into the original June 25, 1999 document).

If the SSP is approved the week of August 16, Solutia is prepared to begin work in the field the week of September 13. However, we are approaching the latest time of the year when work started can be efficiently completed before winter weather begins to create delays. Because of the seasonal issues involved, if the ecological sampling cannot be started in September, the next opportunity will be May / June of 2000 - the next growing season. Also, given the nature of the groundwater sampling program, it cannot be done in severe winter weather. We need to start the Work in September - at the latest - so that the majority of the weather sensitive tasks can be completed before December.

If we have any remaining misunderstandings, we would be happy to discuss further to reach rapid resolution.

Sincerely,

D. M. Light
Manager, Remedial Projects
Solutia Inc.

cc: J. Nassif, Esq. - Thompson Coburn
L. Tape, Esq. - Thompson Coburn
B. Gilhousen, Esq. - Solutia
M. Foresman - Solutia
B. Yare - Solutia

SOLUTIA

Applied Chemistry, Creative Solutions

Solutia Inc.
10300 Olive Boulevard
P.O. Box 66760
St. Louis, Missouri 63166-6760
Tel 314-674-1000

April 8, 1999

To: Mr. Michael McAteer
U. S. EPA - Region 5
77 West Jackson Boulevard (SR-6J)
Chicago, Illinois 60604-3590

Mr. Thomas Martin
Associate Regional Counsel
U. S. EPA - Region 5
77 West Jackson Boulevard (C-14J)
Chicago, Illinois 60604-3590

Mr. Paul Takacs
Illinois Environmental Protection Agency
Bureau of Land
1001 North Grand Ave. East
Springfield, IL 62702

Re: Support Sampling Plan for Sauget Sites Area I January 21, 1999 Administrative Order by Consent

Mr. McAteer, Mr. Martin and Mr. Takacs,

In a March 19, 1999 letter to Solutia, the U.S. Environmental Protection Agency (U.S. EPA) commented on and disapproved Solutia's February 22, 1999 Support Sampling Plan (SSP) submittal pursuant to the January 21, 1999 Administrative Order by Consent (AOC). The U.S. EPA required in the March 19 correspondence that Solutia submit "a final plan on or before April 9, 1999". U. S. EPA further stated that, "....failure to provide U.S. EPA with an approvable Support Sampling Plan that incorporates all attached comments and is in compliance with the AOC will be considered a violation of the AOC. In such event, U.S. EPA will consider its enforcement options including, but not limited to, completing the Support Sampling Plan with no further input from Solutia".

Solutia strongly objects to the U. S. EPA's threat of enforcement action on the basis that enforcement action is unjustified, unwarranted, unnecessary and counter-productive. Solutia has been cooperative with the U.S. EPA in voluntarily signing up to complete the AOC Work and obviously does not intend to be recalcitrant. Solutia has made a good faith effort to comply with the AOC in the short 2 months since it became effective - taking every opportunity with the Agency to show this intent and making every reasonable effort to meet the Agency's expectations. Solutia is quite baffled at U. S. EPA's reasoning reflected in this quick resort to threats of enforcement action.

The enclosed SSP is submitted in accordance with the requirements of the AOC and Statement of Work (SOW); the U.S. EPA's March 19, 1999 comments on Solutia's February 22, 1999 Support Sampling Plan submittal; and the March 25 and March 26, 1999 telephone conference calls between Solutia and the U.S. EPA, USACE, Weston and Illinois EPA (IEPA), held to provide further clarification of the March 19, 1999 comments.

Solutia has made every effort possible to understand and affirmatively address each of the Agency's issues and concerns and knows of no reason why the current SSP submittal is not approvable by the Agency. We have used a qualified team of technical professionals and two peer reviewers experienced with Region V projects to add an additional level of assurance that this SSP submittal meets all applicable guidelines, requirements and expectations of U. S. EPA Region V.

Solutia is agreeing to perform all of the additional Work now encompassed within the SSP, even though the current Work is considerably more comprehensive and more complex than was originally envisioned during the AOC negotiations. As a consequence however, the SSP enforceable schedule proposal, while remaining aggressive, incorporates additional time needed to professionally and efficiently implement the expanded scope of work. Solutia is committed to aggressive execution of the Work and will continue to minimize total project time where practical and cost effective.

Some final details, clarifications and questions regarding the SSP submittal:

1. QAPP 7-step Process Review (Guidance for the Data Quality Objective Process: EPA QA/G-4, Final - September 1994) - The Solutia team is uncertain as to the Agency's expectation on this item. The 7-step review is not included as a part of the current submittal because it is not in the guidance we were instructed to use. However, the experience of some team members suggest that this may be an expectation of Region V. Solutia will comply with the Agency's clarified position on this matter. ✓ w/ QAPP person

2. Public participation - The SSP reflects Solutia's understanding that the U. S. EPA is responsible for the Community Relations Plan required by the NCP and that the Agency will take the lead in community relations and public participation activities. Solutia intends to support the Agency's community relations and public participation efforts and will participate as appropriate. Solutia requests Agency confirmation of concurrence with this understanding. OK

3. Ecological Health & Safety Officer - The Ecological Health and Safety Officer will be named by Menzie Cura within 30 days of this submission.

4. Biota Analysis SOPs - The biota analysis SOPs for the ecological sampling will be delivered within 30 days of this submittal.

Solutia and any member of the project team are available to meet with the Agency to review any questions you may have concerning this SSP submittal.

Sincerely,

D. M. Light
Manager, Remedial Projects
Solutia Inc.

cc: J. Nassif, Esq. - Thompson Coburn
L. Tape, Esq. - Thompson Coburn
B. Gilhousen, Esq. - Solutia
M. Foresman - Solutia
B. Yare - Solutia